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Evidence of Informational Asymmetries from Management Earnings Forecasts and Stock Returns

Maureen McNichols

ABSTRACT: This paper compares the information investors have about a firm's future earnings, as reflected in its stock price, to that of the firm's management, as reflected in its management earnings forecast. Stock returns in the preforecast and forecast announcement period are positively associated with management earnings forecast errors, indicating that stock prices contain information beyond that reflected in management forecasts. This phenomenon can occur if management does not issue its true forecast or if investors have information about earnings that management does not have. The first hypothesis, that management forecasts do not fully reflect management's information, implies that forecasts will be biased in a directional or nondirectional manner. This study conducts tests for directional bias and develops and conducts a test for nondirectional bias, using a sample of management forecasts occurring in years 1979–1983. The hypothesis that management forecasts are biased is only rejected for forecasts made in 1982. Given the magnitude of economic changes occurring in 1982, post-forecast information may well have been negative, causing the average forecast error in 1982 to differ from zero. In the other years studied, the hypothesis that management forecasts are biased is not rejected. The data, thus, suggest that stock prices reflect information beyond that in management earnings forecasts because investors access some information that managers do not.

This paper provides evidence concerning two differences in managers' and investors' information about corporate earnings. The first, which has been widely studied in prior research, concerns the extent that managers have information about future earnings that investors do not have.[1] The second difference, which has received considerably less attention in the accounting literature, concerns the extent that investors have information about a firm's future earnings beyond that of its management.[2] By accessing information sources other than a firm's management, investors have a basis for evaluating the credibility of management's disclosures. The primary

I would like to express my appreciation to the Graduate School of Business at Stanford University for its generous support of this research. Michael Smith, Alison Kirby, D. Shores, Mark Weiner, Michael Boehm, and Andy Eckert provided valuable data collection assistance. Ray Ball, Vic Bernard, Carol Eger, George Foster, Mahendra Gupta, Chuck Horngren, Bob Kaplan, Bill Kinney, Uri Ronnen, Katherine Schipper, Tom Stober, Peter Wilson, and Mark Wolfson provided helpful comments at varying stages of this project. In addition, the constructive comments of two anonymous reviewers are very much appreciated.

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contributions of this paper are to document that investors have information, as reflected in stock prices, that managers do not incorporate into their earnings forecasts and to explore explanations for this finding.

Prior research has documented that stock prices convey information not reflected in time-series predictions of earnings [Beaver et al., 1980; Beaver et al., 1987]. Brown et al. [1985] document that stock prices anticipate information reflected in analysts' earnings forecast revisions. Brown et al. discuss several explanations for their findings. One possibility is that analysts do not incorporate information into their forecasts on a timely basis. A second is that the date analysts' forecasts are included in a data base lags behind the date the forecast is released to clients, causing published analysts' forecasts to seem less timely. A third alternative is that the information set underlying stock prices contains elements that the information set underlying analysts' forecasts does not contain. Because the present study examines whether stock prices reflect information not contained in management earnings forecasts, the first and second explanations are less likely to be applicable. Unlike analysts' forecasts, the date a management forecast is publicly disclosed is known to the researcher. Furthermore, managers provide earnings forecasts relatively infrequently, making it more likely that their forecast reflects their information at the forecast date. Thus, management earnings forecasts provide a natural setting in which to examine differences in information between investors and managers.

A firm's stock price can reflect information not in its management forecast if investors have information not in management's information set or if the forecast does not fully reflect management's information. Although management should have more timely access to firm-specific information than investors, investors may have better information about macroeconomic and industry trends than does management. Alternatively, stock prices can reflect information not in management's forecast if management strategically misrepresents or excludes information in determining its forecast. If we assume that managers' true earnings expectations are unbiased, then forecasts that deviate from true expectations will be biased in a directional or nondirectional manner. Directional bias refers to the case where management forecasts are systematically optimistic or pessimistic. Nondirectional bias occurs when forecasts deviate from management's true conditional expectation, but the deviations in the population have zero mean. In addition to testing for evidence of directional bias, this paper contributes a test for nondirectional bias. This test, based on fairly general assumptions, allows detection of bias when some firms in a sample are conservative and others are optimistic.

These tests for bias are of interest because they differentiate between competing explanations for why investors have information not reflected in management earnings forecasts. Furthermore, the extent to which management forecasts are biased is interesting in its own right. There is a long tradition of regulatory concern over corporate disclosure practices and the reliability of voluntary

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[1] The literature documenting the information content of management forecasts includes Patell [1976], Penman [1980], and Waymire [1984].

[2] Jennings [1987] provides indirect evidence on this issue. He explores the extent to which financial analysts' earnings forecast revisions subsequent to management forecasts explain stock price reactions when management forecasts are released. His hypothesis is that stock price reactions are more pronounced when analysts' subsequent forecast revisions are consistent with management forecasts.

disclosure. Financial analysts have also contended that management forecasts are overly optimistic. A recent article in *Institutional Investor* [Marton, 1987] noted that more analysts are conducting their own primary research because they are "tired of overly optimistic forecasts from companies" and need to know "which companies were speaking with a forked tongue." In addition, prior research examining management forecasts in the late 1960s and early 1970s suggests that management earnings forecasts were optimistic.[3] In contrast to the financial press and prior research, the present analysis of forecasts made during 1979–1983 provides no support for the hypothesis that management forecasts are biased systematically. This study also finds, in contrast to the findings for earlier time periods by Patell [1976] and Penman [1980], that firms are not more likely to issue forecasts which exceed proxies for investors' earnings expectations. Moreover, this study finds no evidence that bias is offsetting in the sample because some firms are optimistic and others are pessimistic.

The paper proceeds as follows. In Section I, the data are described and the measurement of variables is described in Section II. Evidence on the relation between security return behavior and management earnings forecast errors is in Section III. The design and results of a test for directional bias are in Section IV, followed by the design and results of a test for nondirectional bias in Section V. Discussion and implications for future research conclude the paper.

I. DATA

The management forecasts studied here were collected through the Dow Jones Retrieval Service. The Dow Jones Retrieval Service accesses a data base of selected articles published in *The Wall Street Journal* and *Barrons*, as well as unpublished announcements appearing on the Broad Tape. The search specified various "keywords" likely to be observed in a management earnings forecast, such as "expects" and "earnings." The search procedure provided numerous articles that were then read to determine whether the article contained a management forecast meeting the sample selection criteria for this study.

The sample selection criteria are:

1. The article must provide a point forecast of earnings per share for the current fiscal year, or a range or growth forecast such that a point forecast can be estimated.
2. The forecast must be made on or before the last day of the fiscal year.
3. The forecast must be attributed to a company official.
4. The forecast has to be the first forecast released by the firm for the fiscal year. In addition to the text search process, *The Wall Street Journal Index* was checked to verify that no prior forecasts were made for the year.
5. The firm's shares must be traded on the American or New York Stock Exchange.
6. The firm's share price ten days prior to the forecast release must not be less than $10.00.

---

[3] Basi et al. [1976] examine a sample of 88 forecasts made in 1970 and 1971 and report that managers in this time period overestimated earnings by six percent. McDonald [1973] examines a sample of 201 forecasts made during 1966–1970 and reports that the average prediction error is negative in every year. Also, 64 percent of the observations in this time period are overpredictions. Penman [1980] also reports negative average forecast errors for each of his four portfolio groupings. The mean is significantly negative for only one of his portfolios, based on a t-test. The significance of the average across portfolios or years is not reported.

TABLE 1

DATA REQUIREMENTS AND SAMPLE SIZE

1. Management forecast error data requirements:	
a. Firm/forecast observations meeting criteria 1 through 5:	733
b. Observations in 1.a. for which earnings data are available:	675
c. Observations in 1.b. for which preannouncement share price is at least $10.00:	617
2. Analyst forecast data requirements:	
a. Firm/forecast observations meeting criteria 1 through 5:	733
b. Observations in 2.a. for which analysts' forecasts are available:	649
c. Observations in 2.b. for which preannouncement share price is at least $10.00:	610
3. Intersection of requirements 1.c. and 2.c.: Firm/forecast observations with both earnings data and analysts' forecast data	577
4. Firm/forecast observations with earnings data, analysts' forecast, and announcement period returns data	548

Application of the first five criteria led to a sample of 733 forecasts released from June 1979 to December 1983. The above criteria are generally comparable to those applied in prior studies of management forecasts, such as Patell [1976] and Penman [1980]. The second criterion includes forecasts released up to the last day of the fiscal year and is less restrictive than prior studies. However, the results in this paper are not affected when forecasts made in the last month of the fiscal year are excluded. For cross-sectional comparisons, earnings forecast errors are scaled by preannouncement share price. The sixth criterion is imposed to avoid a small denominator.

Additional data requirements are imposed in different analyses reported in the paper. The implications of the additional data requirements for sample size are shown in Table 1. Of the initial sample of 733 forecasts meeting criteria 1 through 5, earnings data are available for 675 of the firms. Earnings data were collected from the 1984 COMPUSTAT Industrials file, *Moody's Industrials*, and *The Wall Street Journal*. Of these observations, 617 have a share price greater than or equal to $10 on the tenth day before the management forecast was announced. Stock price data were collected from the Center for Research on Security Prices (CRSP) 1985 Daily Master File. Of the 733 forecasts meeting criteria 1 through 5, 649 have analysts' forecasts available on the 1985 *Institutional Brokers Estimate System* data base, or in the Standard and Poor's *Earnings Forecaster*. Imposing the requirement that preannouncement share price be greater than or equal to $10 reduced the sample to 610 observations. The intersection of the observations with earnings and analysts' forecast data with those meeting the share price requirement totaled 577 observations. Of these observations, announcement period returns are available for 548 firms. Returns data were collected from the 1985 CRSP Daily Stock Returns file.

The above sampling procedures generated a sample of 733 forecasts and 617 measurable management forecast errors. Management earnings forecast errors are defined as the difference between the earnings number realized and the earnings number forecast by management, appropriately scaled.[4] The distribution of these events over years is in panel A of Table 2. Because the Dow Jones Retrieval Service extends back to June 1, 1979, the sample for 1979 includes forecasts for the last seven months of the year. The distribution of forecast errors over months is in panel B of Table 2. Approximately one fifth of the sample is based on forecasts made in the last month of the fiscal year. Because these observations can differ from forecasts made earlier in the year, all analysis reported in this paper has been replicated without these twelfth-month observations. In all cases, the results are very similar, suggesting that these observations do not differ from forecasts made earlier in the year along dimensions relevant to this study. The number of forecast errors per firm are shown in panel C of Table 2. Approximately half the sample issued only one forecast over the four and a half years studied, and only seven firms issued forecasts in every year. Thus, the tendency of firms to issue forecasts infrequently is comparable to that reported by Patell [1976].

II. MEASUREMENT OF VARIABLES

This study is intended to provide evidence of informational differences between management and investors. For this purpose, it will be useful to consider two forecast-related variables, which are best described in terms of a time line. The sequence of events begins at $t=0$ when analysts issue an earnings per share (*EPS*) forecast. Management issues an *EPS* forecast at $t=1$ and discloses *EPS* at $t=2$. The analysts' earnings forecast error (*EPS* less the median analysts' forecast), reflects the effect of information revealed from $t=0$ and $t=2$.[5] The analysts' forecast error can be decomposed into two components denoted: management's forecast deviation and management's forecast error. The forecast deviation is the difference between management's forecast and the median analysts' forecast at the closest date preceding the management forecast release, suitably scaled. The forecast deviation provides a measure of the change in earnings expectations associated with management's forecast. This component reflects the information about the firm's earnings that management received over the horizon $t=0$ to $t=1$ plus the effects of any bias in management's forecast.[6] Forecast deviations are measured as:

$$fd_i = \frac{\begin{array}{c}\text{Management forecast of } EPS_i\\ -\text{Median analyst forecast of } EPS_i\end{array}}{\begin{array}{c}\text{Preannouncement share price}\\ \text{of firm } i\end{array}}.$$

Preannouncement share price is measured on the tenth day prior to the forecast release.

---

[4] The terms management earnings forecast, *ex post* forecast error, and forecast error will be used synonymously throughout the text.

[5] This assumes that the median of analysts' forecasts fully reflects their $t=0$ information.

[6] In addition to the information learned by management from $t=0$ to $t=1$ and to bias, the forecast deviation reflects any other difference between analysts' $t=0$ and management's $t=1$ information sets, such as a difference in the information sets at $t=0$. The greater the time between $t=0$ and $t=1$, the less this difference will be.

TABLE 2

FORECAST DISCLOSURES OVER TIME AND PER FIRM

Panel A. Distribution of Forecasts Over Years:

Number of Year	*Number of Management Forecasts*	*Number of Forecast Errors*
1979	132	113
1980	161	136
1981	152	125
1982	141	115
1983	147	128
	733	617

Panel B. Distribution of Forecast Errors Over Months in the Fiscal Year:

Month of Fiscal Year	*Number of Forecast Errors*
1	25
2	39
3	30
4	65
5	47
6	36
7	48
8	26
9	39
10	84
11	60
12	118
	617

Panel C. Number of Management Forecasts per Firm:

Number of Management Forecasts	*Number of Forecast Errors*
1	294
2	90
3	28
4	6
5	7
	617

The management forecast error is based on the difference between the (subsequent) *EPS* realization and management's *EPS* forecast. This forecast error reflects information arriving between $t=1$ and $t=2$ and the effect of management bias, and is measured as:[7,8]

$$fe_i = \frac{EPS_i - \text{Management forecast of } EPS_i}{\text{Preannouncement share price of firm } i}.$$

Both forecast deviations and forecast errors are adjusted for stock splits and stock dividends.

Return prediction errors complete the set of variables to be measured. Cumulative daily return prediction errors are estimated by a market model with the CRSP Equal-Weighted Index. The estimation period extends from 520 to 121 trading days prior to the forecast release date. Return prediction errors are cumulated additively over days −120 to day +120, where day 0 is the date the forecast was disclosed on the Broad tape.[9] Also, return prediction errors are measured over two- and four-day intervals covering "event days" −1 and 0 and −2 to +1, respectively. Two-day return prediction errors are examined to focus on a short time period reflecting the management forecast announcement effect for most of the sample. Four-day return prediction errors are examined to pick up potential leakage on day −2 and announcement effects for firms disclosing forecasts after the close of the market on day 0.

III. THE INFORMATION ABOUT EARNINGS CONTAINED IN PRICES AND IN MANAGEMENT FORECASTS

This section examines stock returns in the period surrounding management earnings forecasts to assess whether management forecasts contain information not reflected in stock prices and whether stock prices contain information not reflected in management forecasts.[10] Management forecasts are interpreted as containing information not in stock prices if announcement period stock returns are associated with management forecast deviations. Stock prices are interpreted as containing information not in management forecasts if preannouncement or announcement period stock returns vary positively with management forecast errors, controlling for forecast deviations. If preannouncement or announcement period stock returns are greater for firms that realize earnings in excess of their management forecast, then investors are conditioning on information beyond that of management. In other words, the information reflected in stock prices about the firm's forthcoming earnings is not fully reflected in management's forecast.

Figure 1 plots cumulative average return prediction errors for the sample as a whole. The plot indicates that cumulative returns are negative for the portfolio as a whole during the 241 days surrounding the forecast release date (day 0). The cumulative average return prediction error for the 241-day period is −.034, which is significantly different from zero with less than .01 probability.[11] The negative cumulative average return prediction error suggests that firms releasing forecasts in the 1979–1983 time period are not, on average, experiencing "good news."

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[7] Note that if management overstates its true forecast by an amount b, the expected forecast deviation is b and the expected forecast error is $-b$.

[8] Hereafter, the subscript i will be suppressed except where confusion might result.

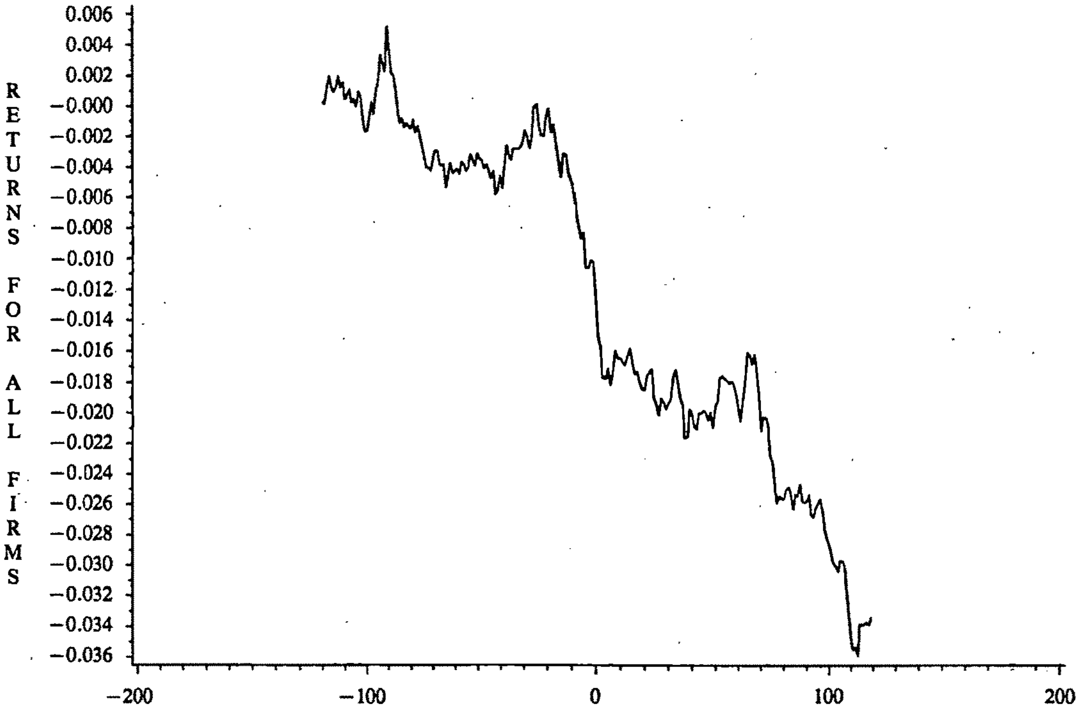
[9] The results reported in this paper are not sensitive to additive cumulation of return prediction errors. Essentially, similar results are observed with multiplicative and continuous compounding. Also, return prediction errors were estimated setting the market model alpha to 0 and beta to 1 with similar results.

[10] The words "returns" and "return prediction errors" are used interchangeably except in Section II.

[11] The t-statistics reported for portfolio returns in Figures 1 through 4 are based on the time-series standard deviation of portfolio returns. Thus, the t-statistics correct for cross-sectional dependence in return prediction errors.

FIGURE 1

CUMULATIVE RETURN PREDICTION ERRORS FOR FIRMS ISSUING MANAGEMENT FORECASTS
(1979–1983)
($n=548$)

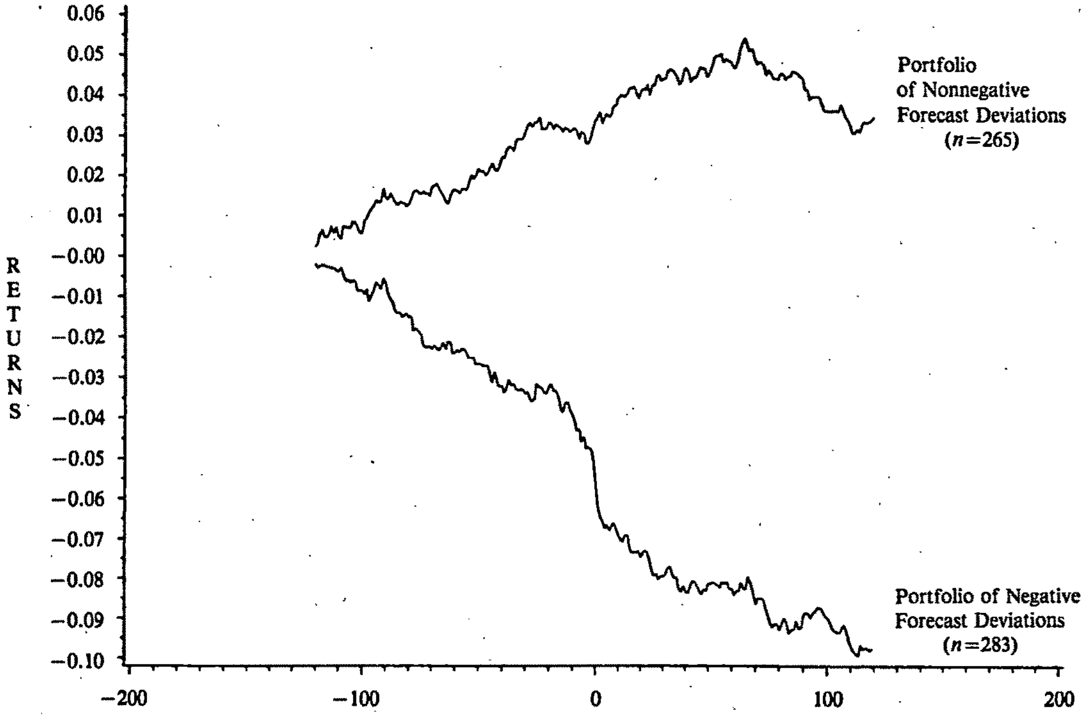


Day 0 is the forecast release date.

Days	Cumulative Return Prediction Error	t-statistic
−120 to −3	−.010621	−1.12
−2 to +1	−.004548	−2.61
−1 to 0	−.001855	−1.50
+2 to +120	−.018222	−1.92
−120 to +120	−.033391	−2.47

As Figure 2 shows, the cumulative return prediction errors for the positive and negative forecast deviation portfolios exhibit considerable separation throughout the forecast release period. Returns are positive in the preannouncement period for firms whose managers release forecasts in excess of the median analysts' forecast and are negative for firms issuing forecasts lower than the median analyst's forecast. The association between forecast deviations and cumulative return prediction errors in the preannouncement period (denoted r_{-120}) is corroborated by the Pearson and Spearman correlations in Table 3. The Pearson and Spearman correlations between forecast deviations and prean-

FIGURE 2
CUMULATIVE RETURN PREDICTION ERRORS FOR PORTFOLIOS FORMED BY THE SIGN OF THE FORECAST DEVIATION (1979–1983)



Day 0 is the forecast release date.

Portfolio of Nonnegative Forecast Deviations

Days	*Cumulative Return Prediction Error*	*t-statistic*
−120 to −3	.027957	2.26
−2 to +1	.006632	2.92
−1 to 0	.003818	2.38
+2 to +120	.000032	0.00
−120 to +120	.034621	1.96

Portfolio of Negative Forecast Deviations

Days	*Cumulative Return Prediction Error*	*t-statistic*
−120 to −3	−.047133	−3.39
−2 to +1	−.015130	−5.91
−1 to 0	−.007379	−4.07
+2 to +120	−.035255	−2.52
−120 to +120	−.097518	−4.91

TABLE 3

CORRELATION MATRIX AND PROBABILITY VALUES FOR SELECTED VARIABLES
PEARSON CORRELATIONS (UPPER DIAGONAL) AND SPEARMAN CORRELATIONS (LOWER DIAGONAL)
(1979–1983)
($n=548$)

	fd_i	fe_i	r_{2i}	r_{4i}	r_{-120i}
Forecast deviation (fd_i)	1.0000 (.0000)	−.0388 (.1770)	0.1065 (.0063)	0.1582 (.0001)	0.0823 (.0309)
Forecast error (fe_i)	−.0250 (.2749)	1.0000 (.0000)	0.06168 (.0747)	0.07695 (.0360)	0.10476 (.0087)
2-day Return Prediction Error (r_{2i})	.1301 (.0013)	.1263 (.0021)	1.0000 (.0000)	0.7852 (.00005)	0.0443 (.3153)
4-day Return Prediction Error (r_{4i})	.2000 (.0001)	.2057 (.0001)	0.7452 (0.00005)	1.0000 (0.0000)	0.0640 (0.1468)
Cumulative Return Prediction Error from −120 to −3 (r_{-120i})	.1672 (.0001)	.1454 (.0004)	.0553 (.2096)	.0473 (.2843)	1.0000 (.0000)

Notes: All probability values (shown in parentheses) are one-tailed except for correlations between r_{-120i} and r_{2i}, and between r_{-120i} and r_{4i}.

r_{2i}=Announcement period return prediction error for firm i, cumulated over days −1 to 0, defining the forecast announcement date as day 0.

r_{4i}=Announcement period return prediction error for firm i, cumulated over days −2 to +1, defining the forecast announcement date as day 0.

r_{-120i}=Preannouncement return prediction error for firm i, cumulated over days −120 to −3, defining the forecast announcement date as day 0.

fd_i=Forecast deviation for firm i, measured as management's *EPS* forecast less analysts' *EPS* forecast, scaled by preannouncement share price.

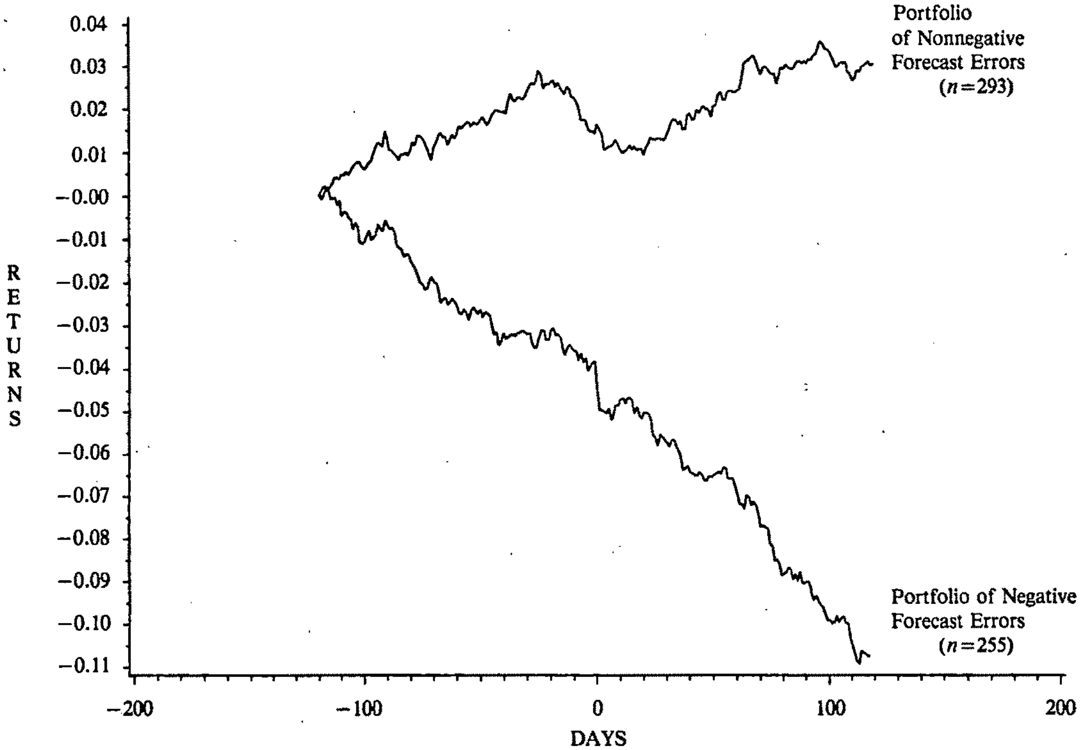
fe_i=Management forecast error for firm i, measured as *EPS* less management's *EPS* forecast, scaled by preannouncement share price.

nouncement cumulative return prediction errors are .082 and .167, which are significantly different from zero with probability values .0309 and .0002, respectively. The correlations indicate that security prices reflect information correlated with forecast deviations, in advance of management forecast announcements. Analysts' forecasts are likely to be at least one to two months out of date and thus, do not fully reflect the information in investors' information sets at the time the management forecast is released. Information arriving between the time analysts' forecasts are made and management's forecast is released is reflected in stock prices in the preannouncement period. Because management forecasts are conditioned on some of this information, forecast deviations and returns in the preannouncement period are correlated. In other words, stock prices at least partially reflect the information in a management forecast in advance of the forecast release because management and investors are responding to the same underlying information.

The cumulative return prediction errors for negative and nonnegative forecast error portfolios in Figure 3 also exhibit considerable separation. Cumulative return prediction errors in the preannouncement period (days −120 to −3) are weakly positive for firms whose

FIGURE 3

CUMULATIVE RETURN PREDICTION ERRORS FOR PORTFOLIOS FORMED BY THE SIGN OF MANAGEMENT EARNINGS FORECAST ERRORS (1979–1983)



Day 0 is the forecast release date.

Portfolio of Nonnegative Management Earnings Forecast Errors

Days	*Cumulative Return Prediction Error*	t-*statistic*
−120 to −3	.014795	1.12
−2 to +1	.000241	0.10
−1 to 0	.001534	0.89
+2 to +120	.015384	1.16
−120 to +120	.030420	1.61

Portfolio of Negative Management Earnings Forecast Errors

Days	*Cumulative Return Prediction Error*	t-*statistic*
−120 to −3	−.039526	−3.28
−2 to +1	−.009994	−4.50
−1 to 0	−.005837	−3.72
+2 to +120	−.056730	−4.69
−120 to +120	−.106250	−6.17

earnings exceeded their management forecast ($t=1.12$), and are significantly negative for firms whose earnings are lower than their management forecast ($t=-3.28$). The t-statistic for the difference in means is 4.10, and the Pearson and Spearman correlations between cumulative return prediction errors in the preannouncement period and forecast errors are .105 and .145, respectively, with one-tailed probability values less than .01. Surprisingly, management forecast errors and returns *prior to the management forecast release* are significantly correlated. The data indicate that preforecast stock prices reflect information about earnings not contained in management forecasts.

Figure 4 shows the cumulative return prediction errors of portfolios formed by the sign of forecast deviations and forecast errors. As in Figure 2, Figure 4 documents preforecast separation of returns for firms with positive versus negative forecast deviations. The cumulative return prediction errors also reveal considerable separation between firms with positive (negative) forecast deviations whose earnings exceeded forecasts and firms with positive (negative) forecast deviations whose earnings fell short of predictions. The postforecast separation of these portfolios is not surprising, as one would expect that events affecting firms over the forecast horizon affect their earnings and stock prices similarly. However, the preforecast separation of returns for firms with positive versus negative forecast errors is striking. The separation documented in Figures 3 and 4 and Table 3 indicates that returns in the preforecast period are correlated with management forecast errors, even after controlling for management forecast deviations. The data, thus, suggest that management forecasts do not fully reflect information about earnings that is aggregated in stock prices.

There are at least two explanations for why stock prices reflect information about earnings beyond that in management earnings forecasts. First, managers can strategically disregard some of their information and consequently allow a role for stock prices to improve their forecasts.[12] Second, managers may be unable to extract the information about investors' expectations of earnings from stock prices. In a noisy rational expectations equilibrium, prices can "reflect" information without revealing it fully, as in Diamond and Verrecchia [1981]. McNichols [1987] shows that if investors have information beyond that of management or if management biases its forecast and investors have information about the nature of the bias, then stock returns (contemporaneous with investors' receipt of information) will reflect information about the management forecast error. If neither condition holds then stock returns and management forecast errors are uncorrelated.

The association between returns, forecast deviations, and forecast errors is also examined using cross-sectional regression. The following cross-sectional regression is estimated to test whether stock price response to management forecasts differs for forecasts that are *ex post* too high or too low:[13]

$$r_{ni}=\beta_1+\beta_2 fd_i+\beta_3 fe_i+\epsilon_i \qquad (1)$$

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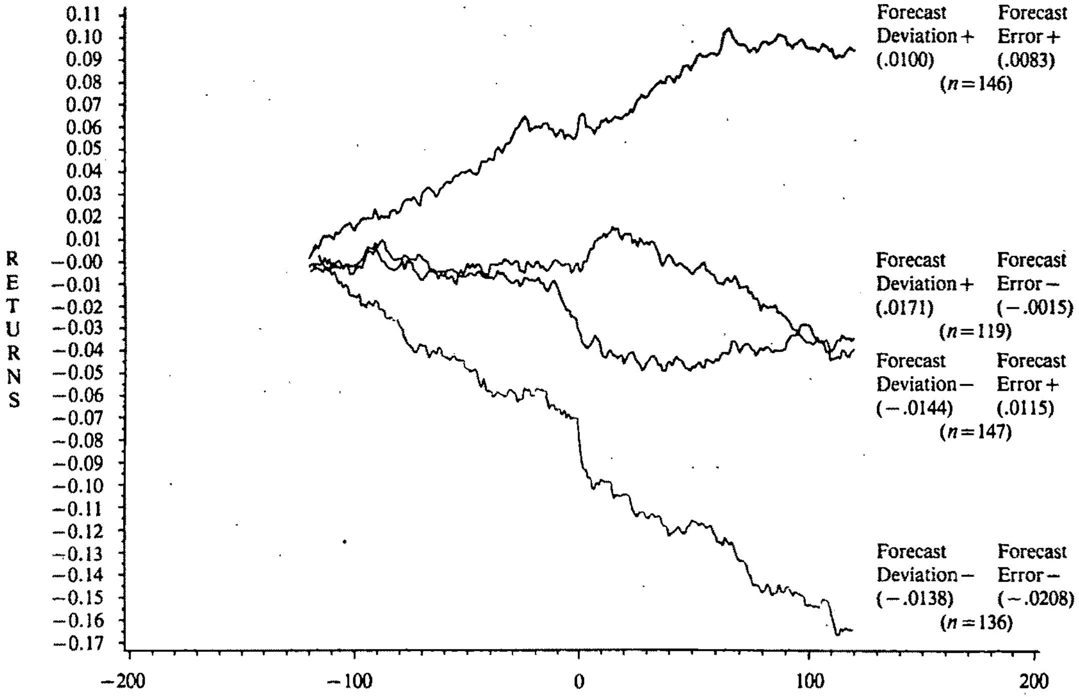
[12] Management may have incentives to issue a biased forecast even if investors can fully "unravel" its implications. This is true if the misrepresentation is targeted to another audience, such as customers or suppliers. Furthermore, if investors know the mean and variance of the bias rather than its realization, they can only partially undo its effects. In this case, stock prices will still reflect information about earnings beyond that in management forecasts.

[13] A related regression is estimated by Jennings [1987]. He regresses forecast week return prediction errors on management's forecast deviations and financial analysts' forecast revisions. The motivation is to assess whether the market responds differently to management forecasts that are not confirmed by financial analysts' forecast revisions. Jennings reports a significant differ-

FIGURE 4

CUMULATIVE RETURN PREDICTION ERRORS FOR PORTFOLIOS FORMED BY THE SIGN OF FORECAST DEVIATIONS AND FORECAST ERRORS
(mean earnings forecast deviation and error are shown in parentheses)
(1979–1983)



Day 0 is the forecast release date.

	Positive Forecast Deviations and Positive Forecast Errors		*Positive Forecast Deviations and Negative Forecast Errors*	
Days	*Cumulative Return Prediction Error*	*t-statistic*	*Cumulative Return Prediction Error*	*t-statistic*
−120 to −3	.054341	3.13	−.004412	−0.21
−2 to +1	.014240	4.44	.000694	0.18
−1 to 0	.009190	4.06	.002773	1.04
+2 to +120	.028877	1.65	−.035980	−1.75
−120 to +120	.094690	3.81	−.039698	−1.35

	Negative Forecast Deviations and Positive Forecast Errors		*Negative Forecast Deviations and Negative Forecast Errors*	
Days	*Cumulative Return Prediction Error*	*t-statistic*	*Cumulative Return Prediction Error*	*t-statistic*
−120 to −3	−.025301	−1.58	−.07025	−3.99
−2 to +1	−.011145	−3.78	−.01935	−5.98
−1 to 0	−.006228	−2.99	−.00878	−3.84
+2 to +120	.001702	−0.10	−.07438	−4.21
−120 to +120	−.034744	−1.52	−.16398	−6.53

where

r_{ni} = return prediction errors for firm i cumulated over n days around day 0, the forecast release date,
fd_i = the management forecast deviation for firm i,
fe_i = the management forecast error for firm i, and
ϵ_i = a normally-distributed error term, assumed to be orthogonal to the above regressors.

The null hypothesis is:

H_{01}: $\beta_3 \leq 0$.

The first two specifications of equation (1) focus on stock price response at the management forecast disclosure date. In these specifications, the dependent variables are return prediction errors cumulated over days −1 and 0 and days −2 to +1, respectively. The third specification is designed to test the correlation between preannouncement returns, forecast deviations, and forecast errors; the dependent variable is return prediction errors cumulated from days −120 to −3. The fourth specification tests the correlation between postannouncement returns, forecast deviations, and forecast errors. Postannouncement returns are cumulated from day +2 to +120.

The estimation results for the first three specifications in Table 4 indicate a significant association between return prediction errors and both forecast deviations and errors. A particularly striking feature of the regression results is the magnitude of the forecast error coefficient relative to the forecast deviation coefficient. One can think of the sum of the forecast deviation (management forecast less the analysts' prior forecast scaled by price) and the management forecast error (*EPS* less management's forecast, scaled by price) as the analysts' forecast error for the horizon beginning the month prior to the management forecast disclosure. In the period prior to the forecast release, prices appear to reflect information about the forecast deviation and error components of analysts' earnings forecast errors to a comparable degree. At the forecast release, stock prices are more highly correlated with the forecast deviation, which is not surprising given that the management forecast fully discloses this component. The forecast error component, although partially reflected in price, reflects the effects of postforecast events, which by definition are yet to be revealed. In other words, the forecast error is a noisy measure of the information investors have about earnings beyond that in the management earnings forecast. In the postannouncement period, returns are strongly correlated with forecast errors, but are not significantly correlated with forecast deviations. These results are intuitive: forecast deviations should be fully reflected in prices before the postannouncement period and, thus, there should be no correlation between postannouncement returns and forecast deviations. Forecast errors reflect the effects of postforecast events to a large degree and,

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ence in return prediction errors to positive forecast errors which are confirmed versus not, but finds no difference in return prediction errors of firms with negative forecast deviations which are confirmed versus not. His design differs from the present design which uses a perfect foresight measure of the investors' information about management's forecast error, rather than analyst forecast revisions. Because analysts are frequently slow to revise their forecasts, many observations that would have been confirmed or disconfirmed are grouped in the no revision category. In addition, the longer the revision period, the greater the likelihood that analysts' forecast revisions reflect information which arrived subsequent to management's forecast release. These design features may cause Jennings' test to be less powerful. In addition, the return results reported here are based on 548 forecast observations. Jennings' sample contains 108 forecast observations. Thus, there are relatively few firms in several of the categories he analyzed.

TABLE 4

THE RELATION BETWEEN RETURNS, MANAGEMENT FORECAST DEVIATIONS, AND MANAGEMENT FORECAST ERRORS

Panel A. Announcement Period Returns:									
r_{2i}	=	β_1	+	$\beta_2 fd_i$	+	$\beta_3 fe_i$	+	ϵ_{1i}	(1)
Coefficients:		−.00049		.182		.075			
t-statistics:		(−0.279)		(2.75)		(1.84)			
		Adjusted R^2:				.014			
		F-statistic:				4.84			
		Probability > *F*:				.0083			
		n:				548			
r_{4i}	=	β_1	+	$\beta_2 fd_i$	+	$\beta_3 fe_i$	+	ϵ_{2i}	(1)
Coefficients:		−.00276		.370		.135			
t-statistics		(−1.142)		(4.07)		(2.40)			
		Adjusted R^2:				.032			
		F-statistic:				9.95			
		Probability > *F*:				.0001			
		n:				548			
Panel B. Preannouncement Returns:									
r_{-120i}	=	β_1	+	$\beta_2 fd_i$	+	$\beta_3 fe_i$	+	ϵ_{3i}	(1)
Coefficients:		−.01247		.583		.519			
t-statistics:		(−1.233)		(1.93)		(2.29)			
		Adjusted R^2:				.013			
		F-statistic:				4.44			
		Probability > *F*:				.012			
		n:				505			
Panel C. Postannouncement Returns:									
$r_{2to120i}$	=	β_1	+	$\beta_2 fd_i$	+	$\beta_3 fe_i$	+	ϵ_{4i}	(1)
Coefficients:		−.008		.380		1.658			
t-statistics:		(−0.83)		(.97)		(4.57)			
		Adjusted R^2:				.036			
		F-statistic:				10.45			
		Probability > *F*:				.0001			
		n:				511			

Notes: $r_{2to120i}$ = Postannouncement return prediction error for firm *i*, cumulated over days +2 to +120, defining the forecast announcement date as day 0.

See Table 3 for definitions of the other variables in this table.

thus, should correlate with postforecast returns. Taken as a whole, these results indicate that investors have access to information that managers do not incorporate into their earnings forecasts.

These findings extend prior research that documents a significant association between return prediction errors surrounding the forecast release and management forecast deviations.[14] The first

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[14] See Patell [1976], Penman [1980], and Waymire [1984]. Patell estimates three models of earnings expectations, based on earnings data in years prior to the fore-

TABLE 5

DESCRIPTIVE STATISTICS: MANAGEMENT FORECAST ERRORS AND COMPONENTS
(1979–1983)
(n=617)

		Fractiles						
Variable	*Mean*	*1%*	*10%*	*25%*	*50%*	*75%*	*90%*	*99%*
Earnings per Share before Extraordinary Items	3.17	−1.25	1.05	1.86	2.90	4.27	5.89	8.87
Extraordinary Items	.0032	1.20	0	0	0	0	.000	.96
Earnings per Share after Extraordinary Items	3.18	−2.17	1.05	1.86	2.92	4.30	5.96	9.91
Management Forecast	3.32	0	1.28	2.05	3.00	4.20	5.92	8.77
Forecast Error (based on Earnings before Extraordinary Items)	−.0067 (t=−3.93)	−.164	−.033	−.0099	−.00001	.0044	.0136	.1049
Forecast Error (based on Earnings after Extraordinary Items)	−.0065 (t=−3.75)	−.164	−.033	−.0099	−.0001	.0048	.0145	.1032
Number of Calendar Days from Forecast Release to Fiscal Year End	143.8	1	16	47	119.5	237	300	360
Preannouncement Share Price	29.77	10.55	14.12	18.82	27.37	36.56	48.3	80.14

Notes: This table provides descriptive statistics on the components of management earnings forecast errors for the 617 observations described in 1.c. of Table 1. These forecast errors are measured as earnings per share less management's forecast of earnings per share, divided by price per share.

two specifications extend this research by documenting an association between forecast period return prediction errors and management forecast errors. The third specification extends prior findings by documenting that stock returns in the preannouncement period, similar to those immediately surrounding the forecast release, are also significantly associated with forecast errors.

As a check on the regression results, the statistical association between return prediction errors and forecast errors (holding the rank of the forecast deviation constant) was tested using the nonparametric Page test of ordered alternatives [Hollander and Wolfe, 1973, pp. 147–150]. The null hypothesis that return prediction errors are not increasing in forecast errors, holding the forecast deviation constant, is rejected at the .05

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cast release, and on Standard and Poor's Composite Earnings Index for the year of the forecast. Penman estimates a time-series model to characterize expected earnings. Waymire compared Penman's forecast sample to analysts' forecasts reported in the Standard and Poor's Earnings Forecaster. Both Patell and Penman report earnings forecasts were in excess of their models' predicted earnings, and Waymire finds forecasts in excess of analysts' forecasts.

level for both two- and four-day return prediction errors.[15] These results provide assurance that the regression results are not driven by extreme values.

IV. DIRECTIONAL TESTS FOR BIAS

Having documented that stock prices reflect information about management forecast errors, the role bias can play in this association is examined beginning with two tests for directional bias.

Management Earnings Forecast Errors

The first test is based on earnings forecast errors. If managers forecast their true expectations of earnings and their true expectations are unbiased, then we would expect the average management forecast error to be statistically indistinguishable from zero for a sample of forecast observations drawn for different firms at different times.

The fractiles of the distribution of management forecast errors and related components are in Table 5. The average management *EPS* forecast is \$3.32, and the average *EPS* realized is \$3.18. Computation of these forecast errors does not appear to be sensitive to inclusion versus exclusion of extraordinary items. The average forecast error is $-.0067$ based on Earnings before Extraordinary Items, and $-.0065$ based on Earnings after Extraordinary Items. The *t*-statistics of -3.93 and -3.75 indicate a significant difference from zero, but are not adjusted for cross-sectional dependence.[16]

The fractiles of forecast errors in Table 5 indicate a negatively skewed distribution. One might argue that extreme negative forecast errors are "driving" the mean effect. The issue requiring resolution is whether extreme negative realizations are generated by management forecasting behavior, or are a consequence of the measurement process. To the extent that managers issue forecasts that lead to extreme negative forecast errors, including these observations in measures of bias is legitimate. On the other hand, if a small denominator problem or comparison of a different earnings measure to the earnings number forecast by management causes more extreme negative forecast error observations, then inclusion of these observations can lead to erroneous inferences about management forecasting behavior. To guard against the small denominator problem, firms with share prices less than \$10 were excluded from the analysis. Also, all forecasts were checked to verify that the forecast includes a prediction of net income or earnings per share. Thus, the interpretation that the *ex post* forecast error distribution reflects management forecast errors seems justified.

The following model provides a control for differences across years in management forecast errors:

$$fe_{it}=\alpha_t+\omega_{it} \tag{2}$$

where

fe_{it} = the forecast error for firm i with a fiscal year end in calendar year t,
α_t = the average forecast error for calendar year t, and
ω_{it} = a normally-distributed error term, assumed to be orthogonal to the above regressors.

The above estimation corrects for cross-sectional dependencies to the extent that

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[15] The Page test was conducted for a three-by-three grouping of management forecast deviations and forecast errors. The results are similar when the Page test is applied to mean and median two-day return prediction errors, and when the data are grouped into more than three categories of forecast deviations and errors.

[16] Because the management forecast horizons overlap, the forecast errors are subject to common macroeconomic or industry factors. The positive correlation among forecast errors leads to downward-biased standard errors, and upward-biased *t*-statistics.

TABLE 6
YEAR EFFECTS IN MANAGEMENT EARNINGS FORECAST ERRORS[1]
(n=617)

$$fe_{it}=\alpha_t+\omega_{it} \qquad (2)$$

Year Effects[2]

Year	α_t	*Standard Error*	*Probability Value* $\alpha_t=0$	*Median* fe_{it}
1979	−.0010203	.003898	.7936	.00099
1980	−.0017447	.003553	.6236	.00016
1981	−.0041393	.003706	.2645	.00000
1982	−.0276387	.003863	.0001	−.00478
1983	−.0008349	.003624	.8219	.00099

Model Information[3]

F-statistic (4,612):	10.55
Probability > F:	.0001
R^2:	.08
n:	617
Number of parameters:	5
Number of years:	5

Hypothesis Tests[4]

Hypothesis	t-*statistic*	*Two-tailed Probability*>t
$\alpha_t=0$ for all years	−4.23	.0001
$\alpha_t=0$ for all years except 1982	−1.04	.2976

---

[1] For equation (2), the average forecast error, α_t, is computed by ordinary least squares for each year.

[2] The average forecast error in year t, α_t, is shown with its standard error, the probability value that $\alpha_t=0$, and the median forecast error.

[3] The F-statistic, with 4 and 612 degrees of freedom, tests the hypothesis that management forecast errors are equal across years. This hypothesis is rejected at a significance level less than .0001.

[4] The hypothesis that $\alpha_t=0$ for all years is rejected at a significance level less than .0001. The hypothesis that $\alpha_t=0$ for 1979, 1980, 1981, and 1983 is not rejected at a conventional significance level.

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they are captured in the year effect. Under this assumption, the estimated error term is independently distributed (for further discussion, see O'Brien [1988]).

Two hypotheses are examined. First,

H_{02}: The average forecast error equals zero in each year.

The second hypothesis focuses on the average of the year effects:

H_{03}: The average of the α_t(the year effects) equals zero.

If each year effect is weak, but in the same direction across years, we can reject H_{03} while failing to reject H_{02}. Conversely, offsetting nonzero means in different years can lead to rejection of H_{02} but not to rejection of H_{03}.

The estimation results for equation (2) are shown in Table 6. The F-statistic for the model indicates that the year in which a forecast is released explains a statistically significant portion of the variation in management earnings forecast errors. Thus, the second null hypothesis is rejected. The third null hypothesis is also rejected, with a t-statistic of -4.23 across all years. However, the t-statistic for the average of the year effects for all years excluding 1982 is -1.04. This suggests that the average forecast error is negative primarily because of the 1982 forecast error observations.[17] Median forecast errors, also reported in Table 6, are positive in every year except 1982. Thus, although weak evidence of an average effect of optimism exists, this effect is due to a few firms' extremely negative forecast errors rather than a tendency of most firms to issue forecasts in excess of the earnings number realized.

It has been assumed thus far that management has no discretion over the earnings number ultimately reported. In some instances, management can exercise discretion to move the period's reported earnings number in the direction of the number initially forecast. If this occurs in a material way, the notion of bias applied in this study must be modified, possibly to include the level of discretion management expects to use, and the level of discretion expected by investors. One would expect, however, that if there is substantial discretion over reported earnings and investors anticipate that management will exercise discretion, then the relation between announcement returns and management forecast deviations should be weak. The observed strength of this relation suggests that the amount of this discretion is small. Nevertheless, the nature and extent of earnings management by forecasting firms remain as interesting issues for future research.

Management Earnings Forecast Deviations

Additional evidence of directional bias can be derived from management forecast deviations (the deviation of the management forecast from the median of analysts' forecasts immediately prior to the management forecast, appropriately scaled). If we assume that analysts' forecasts are unbiased, and that the information received by firms but not incorporated in analysts' earnings forecasts is drawn from a distribution with zero mean, then the unconditional expectation of the management forecast deviation is the average "reporting" bias. "Reporting bias" here means the deviation of a manager's earnings forecast from the manager's conditional expectation of earnings. If firms tend to issue forecasts when their earnings expectations exceed those of analysts', there will be an effect on forecast deviations due to selection bias as well. Finally, if analysts' forecasts also are biased, then the average forecast deviation will equal the average difference between management's expectation of earnings and analysts' (selection bias) plus the difference in the average bias of managers and analysts. The fractiles of the distribution of forecast deviations and of the distributions of their components are in Table 7. Although the mean and median forecast deviation are weakly negative, the mean forecast deviation is not significantly different from zero. The data suggest that the average effects of selection bias, re-

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[17] In light of substantial forecast errors with regard to performance of many aspects of the economy in 1982, it is plausible that the 1982 forecast errors reflect economic shocks to firms' earnings in the postforecast period. However, it is also possible that firms have more incentive to issue optimistic forecasts when events are unusually bad or that strategic optimism is more difficult to detect in recessionary periods.

TABLE 7

DESCRIPTIVE STATISTICS: FORECAST DEVIATIONS AND COMPONENTS
(1979–1983)
($n=577$)

Variable	Mean	Fractiles						
		1%	*10%*	*25%*	*50%*	*75%*	*90%*	*99%*
Analysts' Median Forecast of Earnings per Share	3.43	.279	1.41	2.16	3.14	4.46	5.93	8.58
Management Forecast of Earnings per Share	3.43	−.158	1.39	2.15	3.15	4.39	6.00	9.09
Number of Analysts Providing Forecasts	9.87	1	2	5	8.5	14	19	27
Management Forecast Deviation	−.00050 ($t=-.303$)	−.110	−.022	−.006	−.0005	.0046	.016	.108

Notes: This table provides descriptive statistics on the components of management forecast deviations. All of the above are based on the sample of 577 observations for which both forecast deviations and errors could be computed (see 3 in Table 1). Forecast deviations are measured as management's forecast of earnings per share minus the median of analysts' forecasts, scaled by the share price ten days prior to the forecast announcement.

porting bias, and information received by management in the preannouncement and announcement periods are either minimal or are offsetting.[18]

The following model permits a test for differences in forecast deviations across years:

$$fd_{it}=\gamma_t+\nu_{it} \qquad (3)$$

where

fd_{it} = the forecast deviation for firm i in year t,

γ_t = the average forecast deviation for calendar year t, and

ν_{it} = a normally-distributed error term, assumed to be orthogonal to the above regressors.

The fourth hypothesis tested is whether average forecast deviations are significantly different from zero in any year:

H_{04}: The average forecast deviation, γ_t, equals zero in each year.

The fifth hypothesis concerns the average of the year effects. The null hypothesis is:

H_{05}: The average of the γ_t, the year effects, is zero.

The estimation results for equation (3) are in Table 8. The model F-statistic is .74 and the associated probability value is .5938, indicating that the null hypothesis that average forecast deviations differ from zero in any year is not rejected. Also, the hypothesis that the average of the year effects is zero is not rejected. In four of the five years studied, the average and the median forecast deviation

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[18] Selection bias can be present when the average forecast deviation is zero. For example, fewer firms might forecast in years in which average forecast errors are negative. Inferences about all forms of selection bias require descriptive statistics on the reference population. For investigations of self-selection by firms issuing management forecasts, see Imhoff [1978] and Lev and Penman [1987].

TABLE 8

YEAR EFFECTS IN MANAGEMENT FORECAST DEVIATIONS[1]

($n=577$)

$$fd_{it}=\gamma_t+v_{it} \tag{3}$$

Year Effects[2]

Year	γ_t	*Standard Error*	*Probability Value* $\gamma_t=0$	*Median* fd_{it}
1979	.0033662	.002756	.2224	.000730
1980	−.0017177	.002481	.4890	−.000834
1981	−.0027118	.002529	.2841	−.001477
1982	−.0016387	.002669	.5396	−.001667
1983	−.0011364	.002529	.6534	−.000573

Model Information[3]

F-statistic (4,572):	.74
Probability$>F$:	.5938
R^2:	.004
n:	577
Number of parameters:	5
Number of years:	5

Hypothesis Tests[4]

Hypothesis	t-*statistic*	*Two-tailed Probability*>t
$\gamma_t=0$ for all years	−0.66	.5086

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[1] For equation (3), the average management forecast deviation, γ_t, is computed by ordinary least squares for each year.

[2] The average forecast deviation in year t, γ_t, is shown with its standard error, the probability value that $\gamma_t=0$, and the median forecast deviation.

[3] The F-statistic, with 4 and 572 degrees of freedom, tests the hypothesis that forecast deviations are equal across years. This hypothesis is not rejected at a conventional significance level.

[4] The hypothesis that $\gamma_t=0$ for all years is not rejected at a conventional significance level.

are negative, but the magnitude of the year effects is small. Thus, unlike management earnings forecast errors, the average of the forecast deviations does not appear to be influenced primarily by the events in a single year. The finding that management forecasts are not significantly greater than analysts' forecasts is surprising given the results reported for the 1963–1967 period [Patell, 1976] and for the 1969–1973 time period [Penman, 1980; Waymire, 1984]. However, these results are consistent with those of Ajinkya and Gift [1984]. Ajinkya and Gift report that the average forecast deviation for their sample in the 1970–1977 period is not significantly positive.

V. A NONDIRECTIONAL TEST FOR BIAS

Taken as a whole, the forecast deviation and forecast error results suggest that management may tend toward optimism, but that with the exception of 1982, this tendency is very weak. How-

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ever, if some firms have incentives to be conservative in forecasting, their forecast errors could offset those of firms tending to optimism such that very weak effects are observed in the sample as a whole. A nondirectional test of bias is thus proposed to test for this possibility.[19]

The nondirectional test is based on fairly general assumptions about factors giving rise to forecast deviations and forecast errors. Forecast deviations and forecast errors can be decomposed into a component due to bias, $\tilde{b}$, and residual components, $\widetilde{tfd}$ and $\widetilde{tfe}$, which can be thought of as the "true" forecast deviations and "true" forecast errors:

$$\widetilde{fd} = \widetilde{tfd} + \tilde{b}$$
$$\widetilde{fe} = \widetilde{tfe} - \tilde{b}.$$

The covariance between $\widetilde{fd}$ and $\widetilde{fe}$ is equal to:

$$\begin{aligned}\mathrm{Cov}(\widetilde{fd},\widetilde{fe}) = {} & \mathrm{Cov}(\widetilde{tfd},\widetilde{tfe}) - \mathrm{Cov}(\widetilde{tfd},\tilde{b}) \\ & + \mathrm{Cov}(\widetilde{tfe},\tilde{b}) - \mathrm{Var}(\tilde{b}).\end{aligned}$$

If we assume that analysts' forecasts are unbiased and that management forecasts (before bias) fully reflect management information, then the first covariance term equals zero. The deviation of management's true expectation from prior analysts' forecasts ($\widetilde{tfd}$) should not be correlated with management's true forecast error ($\widetilde{tfe}$) which derives from post-forecast events. The covariance between $\widetilde{tfe}$ and $\tilde{b}$ is zero for a similar reason: $\widetilde{tfe}$ derives from information management does not have at the forecast date and, thus, $\tilde{b}$ cannot be chosen to depend on $\widetilde{tfe}$. The second covariance term is also zero if we make the stronger assumption that management's choice of bias does not depend on management's "true" forecast deviation, $\widetilde{tfd}$. Under these assumptions, the covariance between observed forecast deviations and forecast errors is minus the variance of the bias.[20]

The intuition behind the covariance result is illustrated in Figure 5. Assume analysts forecast \$1 in earnings per share (*EPS*) for a given firm. Also assume (without loss of generality) that the manager's conditional expectation of *EPS* at time t is \$1. Finally, assume that there are equal probabilities that *EPS* will be \$0.75, \$1, and \$1.25. Under these assumptions, there will be no correlation between forecast deviations and forecast errors if the manager releases an unbiased forecast. In the example, the forecast deviation is zero in all cases. However, if managers hold expectations above or below those of analysts, the same result obtains: when a forecast is unbiased, the expected forecast error is zero, and the difference between *EPS* and the manager's forecast will not depend on the management forecast deviation. Panel B shows the implications of deviating from the conditional expectation. If the manager's expectation of *EPS* is \$1, but he deviates and forecasts \$1.25 (point $F1$ on the graph) then his expected forecast error will be negative. Similarly, if the manager is "conservative" and forecasts \$0.75, the expected forecast error is positive. Thus, conservatism and optimism induce negative covariance between forecast deviations and errors. Note also that rounding error can induce negative covariance between forecast deviations and errors. Interpretation of the empirical results, thus, depends on the magnitude as well as the sign of the covariance between forecast deviations and forecast errors.

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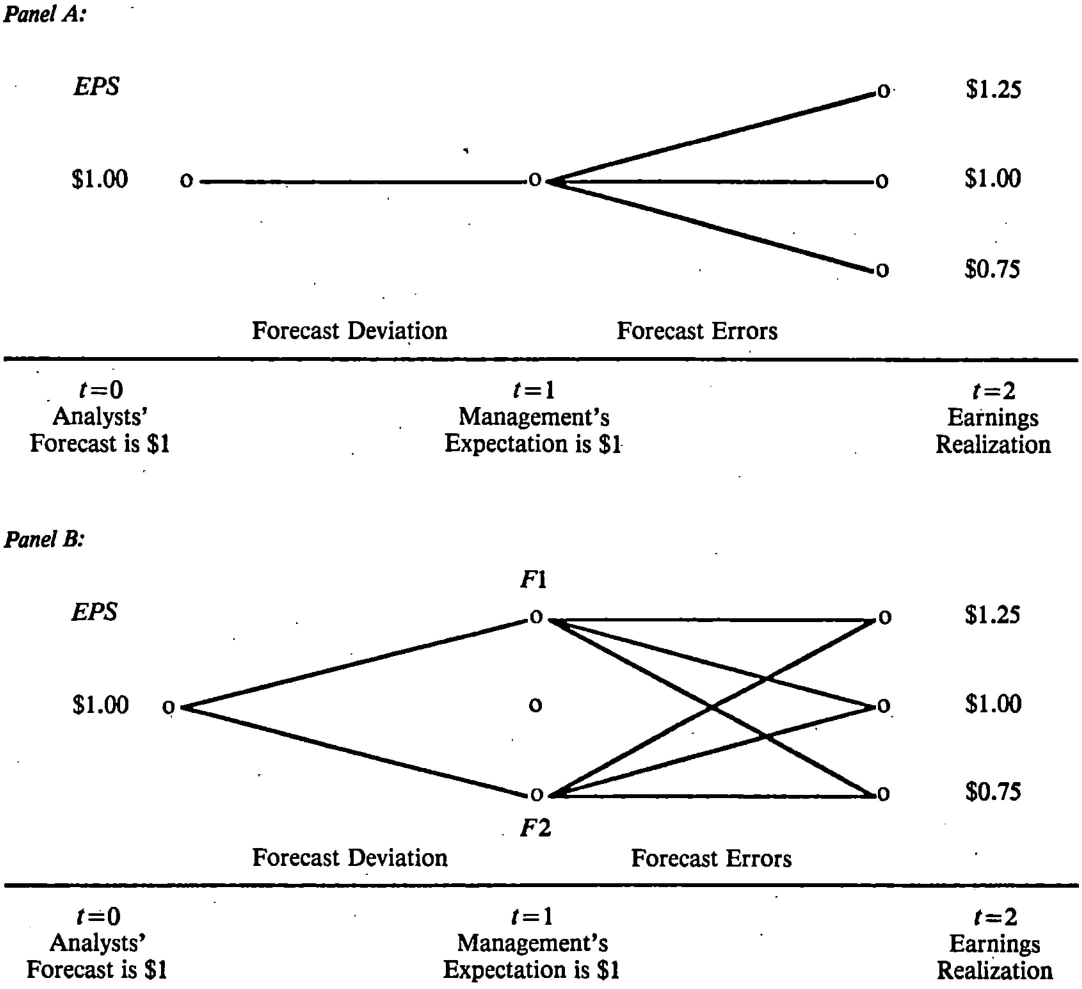
[19] The comments of an anonymous referee substantially improved the exposition of this test.

[20] The mean of the bias does not enter into this result. As such, this test is applicable to cases with nonzero bias. Given the availability of directional tests, however, the nondirectional test is perhaps most useful for cases where the average bias is close to zero.

FIGURE 5

THE RELATION BETWEEN BIAS AND THE COVARIANCE OF FORECAST DEVIATIONS AND FORECAST ERRORS

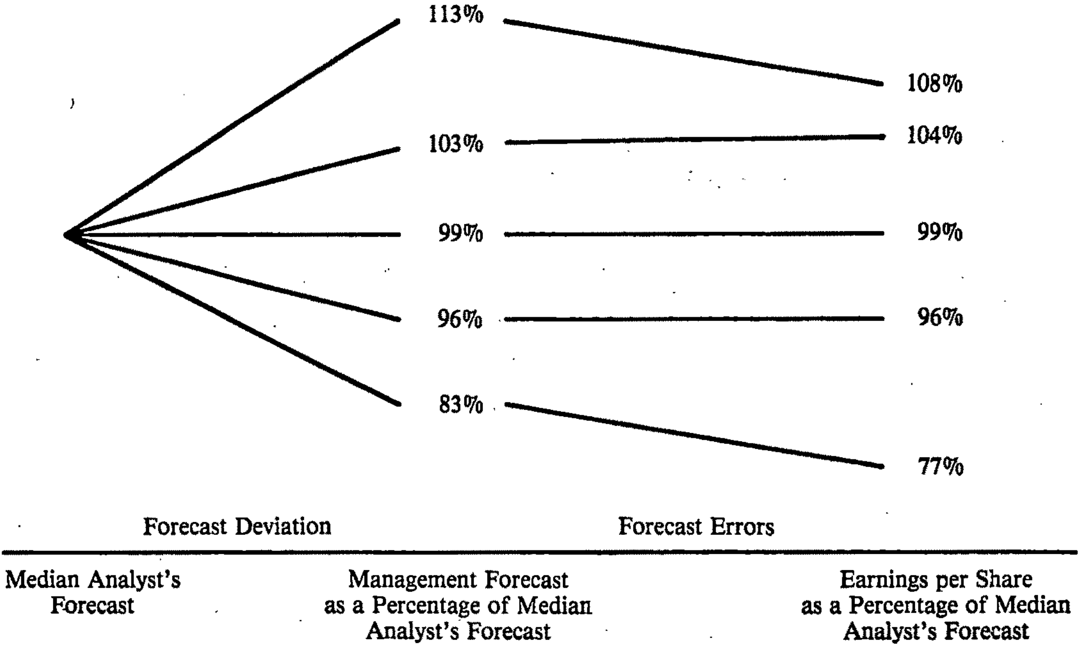


Note: In panel A, management issues an unbiased forecast and forecast errors are uncorrelated with forecast deviations. In panel B, $F1$ and $F2$ indicate forecasts which deviate from management's conditional expectation. Either deviation induces negative correlation between forecast deviations and forecast errors.

The result that the covariance between forecast deviations and forecast errors is minus the variance of the bias rests on two key assumptions. First, it assumes that analysts' forecasts are unbiased. Second, it assumes that the bias in a forecast is independent of management's true forecast deviation. O'Brien [1988] provides some empirical support for the first assumption. The second assumption is more restrictive; we would not literally expect the bias in forecasts to be independent of management's true forecast deviation, which reflects management's new information about the economy and/or the firm. If the amount of bias is

Figure 6

Forecast Errors Grouped by the Rank of the Forecast Deviation



Note: This figure shows the earnings per share realized as a percent of the median analyst's forecast for portfolios formed by the ratio of management's forecast to the median analyst's forecast. The difference between management and analysts' forecasts is the (unscaled) forecast deviation. The difference between earnings per share realized and earnings per share forecast by management is the forecast error.

decreasing in management's true forecast deviation, then the covariance between $\tilde{tfd}$ and $\tilde{b}$ is negative and will reduce the negative covariance among forecast errors and deviations predicted in the presence of bias. In this case, the ability to detect bias through the covariance between observed forecast deviations and forecast errors is weakened.

To assess whether the data reject the assumption that true forecast deviations and bias are uncorrelated, the forecast errors of firms with the most positive to the most negative forecast deviations are examined. Five portfolios are formed on the basis of the ratio of the management forecast to the median analysts' forecast. Firms in the first portfolio have the most positive (percent) forecast deviations and firms in the fifth portfolio have the most negative forecast deviations. The median management forecast as a percentage of analysts forecasts is plotted in Figure 6 for each of the five portfolios. The median earnings per share as a percentage of analysts forecasts is also shown for each portfolio. The plot in Figure 6 suggests that firms with the most positive and negative forecast deviations issued forecasts which exceeded earnings. The median forecasts of the middle portfolios appear to be unbiased. The data, thus, suggest that the direction of bias does not depend on whether the firm issues a forecast exceeding or falling short of analysts' earnings forecasts.

The nondirectional test implies that forecast deviations and errors should be negatively correlated in the presence of bias. Formally,

> H_{06}: The correlation between forecast deviations and forecast errors is greater than or equal to zero.

The Pearson and Spearman correlations between forecast deviations and forecast errors are shown in Table 3. Both correlations are negative, as one would expect if bias occurs. However, the Pearson correlation (−.0388) and the Spearman correlation (−.0250) are insignificantly different from zero. Thus, the null hypothesis that management forecasts are unbiased is not rejected in favor of the alternate of nondirectional bias.[21]

VI. DISCUSSION

This study provides several contributions to the literature on management earnings forecasts and to the literature on the information content of stock prices. First and foremost, this study documents that return prediction errors in the two days and four days surrounding the forecast release are significantly associated with both forecast deviations and forecast errors. This association indicates that management forecasts contain information not previously reflected in stock prices and that stock prices reflect information about earnings beyond that in management forecasts. The differential response to forecasts which are *ex post* too high or too low indicates that, in the aggregate, investors do not take management forecasts at face value. Correction of errors takes place either because strategic behavior in forecasting is detected or because investors' expectations of earnings are conditioned on information not accessed by management. The potential magnitude of the difference between management and investor information sets is an empirical question with important implications for how we explain various accounting-related institutions.

This study also contributes tests for directional and nondirectional bias. The directional results document that, except for 1982, management forecasts are not systematically biased. The nondirectional test developed in this paper relies on the relation between forecast deviations and postforecast errors. The results of this test provide no support for nondirectional bias. Given the very weak evidence of bias in management forecasts, I conclude that the correlation between announcement period return prediction errors and forecast errors is more likely due to investors with better information about macroeconomic or industry conditions than management. In addition to the substantive findings of this study, the tests for bias developed here should be applicable in other forecasting contexts where the detection of bias is of interest. For instance, one could apply the directional and nondirectional tests to departments forecasting demand for capacity. The approach developed here might also be used to study forecasts of electric utilities used in the rate-setting process.

Finally, an unexpected outcome of sampling management forecast practices in the 1979–1983 time period is the indication that forecast practices in more recent years differ from prior periods studied. Prior research has focused primarily on samples of forecasts in the 1960s and early 1970s. The results from these time periods suggest managers tended to issue forecasts that were favorable relative to preforecast expectations [Patell, 1976; Penman, 1980; and Waymire, 1984] and that managers tended to optimism in their forecasting practices [McDonald, 1973; Penman, 1980]. The data presented here provide little support for optimism in forecasting, and no support for an average tendency to issue forecasts which convey "good news." One might argue that the Safe Harbor Rule of the SEC, instituted in 1979 [U.S. Securities and Exchange Commission, 1979], has affected management forecasting practices leading to some of the differences documented here for the 1979-1983 period relative to prior periods. If the Safe Harbor Rule reduced concerns that management forecasts increase liability exposure, managers with unfavorable earnings news may face lower costs of timely disclosure.[22] It is also possible that methodological differences contributed to the difference in findings over time. However, since both the forecast deviations and forecast errors are measured in a manner similar to prior studies, I expect that differences due to method are small.

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[21] Note that this test of nondirectional bias tests for evidence of bias across the sample. It can be that by isolating circumstances where firms have incentives to bias forecasts up or down, a more powerful test can be constructed.

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[22] This argument assumes that it was more costly for negative forecast deviation firms to release forecasts. It is also possible that the Safe Harbor rule affected the benefits of forecasting, perhaps differentially.

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A Test of the Incremental Explanatory Power of Opinions Qualified for Consistency and Uncertainty

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ABSTRACT: The nature of auditors' qualified opinions gives rise to the belief that they can signal entity failure. This study examines the association between audit report qualifications and financial failure. Using the log-linear approach, the association between bankruptcy and audit qualifications is investigated for a univariate and two multivariate models. For the year immediately preceding bankruptcy, the univariate model tests indicate an association between consistency, going-concern, and other subject-to qualifications and bankruptcy. Tests of the multivariate models, which use audit report variables in conjuction with each other, indicate an association with bankruptcy for both the going-concern and other subject-to qualifications. When the audit report variables were tested jointly with a set of ratios comprising a bankruptcy-prediction model, the consistency and going-concern qualifications were still significantly associated with bankruptcy. The analysis also considered the predictive ability of the models while testing the sensitivity of the results to varying costs of Type I versus Type II errors. The results indicated that, in the majority of cases, the audit-opinion-only model is the least-cost alternative (ignoring analysis costs) in the last three years prior to bankruptcy. A naive strategy of predicting all companies as nonbankrupt performs as well as the statistical models in the fourth and fifth years prior to bankruptcy.

THE public has been consistent in its demands for qualified opinions as early-warning signals of entity failure [*Journal of Accountancy*, 1982, 1983]. Mednick [1986] and Connor [1986] point to the increasing forcefulness of such demands. The purpose of this research, therefore, is to explore the question of the ability of qualified opinions to serve as warning signals for bankruptcy.

A qualified opinion means that "except for" or "subject to" the effects of a particular matter, the financial statements present fairly the financial posi-

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tion, the results of operations, and changes in financial position in conformity with generally accepted accounting principles. An except-for opinion is issued when the scope of the auditor's examination is limited, when the financial statements depart from generally accepted accounting principles, or when generally accepted accounting principles have not been consistently applied. A subject-to opinion is issued when uncertainty exists about the outcome of a particular event; this includes the case where there are doubts about the continued existence of an entity [*AICPA*, 1987, secs. 509 and 340].[1] Opinions qualified because of either scope limitations or a departure from GAAP are rare, especially in the population of concern in this research, the New York and American Stock Exchange companies. Accordingly, our investigation is confined to the consistency exceptions and to subject-to opinions (including those qualified for uncertainties about continued existence).[2] As discussed below, it is reasonable to believe that there is a significant association between these types of modified opinions and bankruptcy; therefore, these types of opinions may serve as a "red flag" for financial statement users.

The usefulness of an opinion modification as a red flag does not necessarily mean it has *unique* information regarding bankruptcy prediction. Consistency exceptions and subject-to opinions including those issued for going-concern uncertainties are accompanied by footnote disclosure of the events or conditions that give rise to the qualification. However, if there is a significant association between those qualifications and bankruptcy, then the consistency exception and subject-to opinions for other than going-concern uncertainties may serve as warning signals for financial statement users. This would indicate that there are footnote disclosures that merit attention by users.[3]

Several researchers have tested the information in qualified opinions by testing the association between the qualifications and unexpected returns on securities. Firth [1978], Ball et al. [1979], and Chow and Rice [1982] conclude that qualified opinions contain information. Similarly, Banks and Kinney [1982] found prior-to-annual-report negative risk-adjusted returns for those companies receiving an uncertainty qualification, and those companies receiving an unqualified opinion but with uncertainties disclosed in a footnote. Elliott [1982] and Dodd et al. [1984] also found that abnormal returns occur prior to the announcement of the qualified opinion, but they concluded that the opinion itself does not contain information. Recently, Dopuch et al. [1986] found a significant negative stock price reaction to media disclosures of subject-to qualified opinions. Finally, these researchers, along with Bailey [1982], point out that since the audit opinion is concurrently reported with the financial statements it is difficult to isolate market reactions to the audit opinion.

The present research uses a nonmarket, log-linear approach that controls for the concurrent release of the financial statements and the audit opinion through tests for incremental explanatory power. Although previous studies (discussed below) have analyzed the occurrence of those audit opinions qualified one year prior to bankruptcy, such studies have concentrated on the going-concern opinion. In particular, in those studies the predictive accuracy of the auditor's qualified opinion was compared to that of a financial-ratio-based bankruptcy prediction model.[4]

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[1] There are also cases in which the auditor will disclaim an opinion for scope limitations or for material uncertainties [AICPA, 1987, secs. 509.10–.13, 509.21–.26, and 340].

[2] SAS No. 58 [AICPA, 1988a], *Reports on Audited Financial Statements*, and SAS No. 59 [AICPA, 1988b], *The Auditor's Consideration of an Entity's Ability to Continue as a Going Concern* supersede the "subject-to" opinion qualification with a required discussion of an uncertainty in an explanatory paragraph.

[3] This is consistent with recent statements from the SEC regarding the ability of the audit report to provide important signaling information to financial statement users (see fn. 5).

Previous research and professional standards (discussed below) indicate that the consistency exception issued for voluntary accounting changes and the subject-to opinion issued for other than going-concern uncertainties are also associated with bankruptcy. This paper studies consistency exceptions and also incorporates all subject-to opinions including those issued because of going-concern uncertainties. The ability of the qualified opinion to serve as a red flag is assessed within the context of one univariate and two multivariate models. Using a log-linear analysis, coefficients are estimated and tested to assess the informativeness of the qualifications. In addition, analyses are conducted on the predictive ability of the models, and tests are made of the sensitivity of the results to varying costs of Type I versus Type II errors. The results indicate that, depending upon the model, the consistency exception, the going-concern opinion, and other subject-to opinions all have the ability to serve as red flags. The audit-opinion-only model is, in the majority of cases, the least-cost alternative in the last three years prior to bankruptcy. In the fourth and fifth years prior to bankruptcy, the more sophisticated models do not beat the naive strategy of predicting all companies as nonbankrupt. The results are, of course, dependent on the power of the bankruptcy-prediction model itself. Although care was taken in the choice of the ratio model, a better model might indicate that the modified opinions do not have incremental explanatory power.

The next section provides a conceptual framework for hypothesis development in terms of previous research and professional standards. Sections II and III discuss the method and empirical results, respectively. Section IV provides a summary and conclusions.

I. CONCEPTUAL FRAMEWORK

As stated above, financial statement users have argued that qualified opinions are useful warning signals for bankruptcy. This section presents arguments and discusses the academic and professional literature in support of such a position in order to provide a conceptual framework for the hypothesis that there is an association between qualified opinions and bankruptcy. The discussion focuses on the consistency exception and the subject-to opinion issued for other than going-concern uncertainties (hereinafter called the subject-to opinion). Finally, qualifications issued because of going-concern uncertainties (hereinafter called the going-concern opinion) are discussed.

The Consistency Exception

Whenever there is an accounting principles change, the auditor's opinion includes a consistency exception. That is, GAAP has been applied on a consistent basis "except for" the accounting change [AICPA, 1987, sec. 509.20].[5] Research discussed below suggests that there is an association between bankruptcy and accounting changes and, thus, association between bankruptcy and consistency exceptions.

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[4] Collectively, these studies found the statistical model to be a better predictor of failure than the auditor.

[5] The Auditing Standards Board recently attempted to remove all reference to the consistent application of GAAP from the auditor's opinion. The staff of the Chief Accountant of the SEC maintains that reference to inconsistent applications of GAAP should not be dropped

Schwartz [1982] argued that in order to retain investor confidence, managers may use accounting tactics to bolster earnings per share. He compared material accounting changes made by financially-distressed companies to those made by a sample of apparently healthy companies matched by industry and size. He included only voluntary and non-LIFO related accounting changes, and defined an accounting change as either a change in accounting principle or a change in accounting estimate. An accounting change was regarded as material if it had an effect on income that was ten percent or more of the average pretax income over a four-year period, or if it resulted in the reporting of positive rather than negative earnings per share. The materiality classification was made without regard to the auditor's opinion decision.

Within the distressed sample Schwartz found the ratio of income-increasing to income-decreasing changes to be 3.3 to 1. When he examined the bankrupt companies alone, he found this ratio to be 11 to 1. He then compared the distressed sample with a group of healthy companies. The distressed firms made twice as many material accounting changes and four times as many material income-increasing changes as did the healthy firms. He also found that many of the distressed companies had made more than one accounting change over the test period. These results strongly suggest that managers are likely to engage in "creative accounting" when facing financially-distressed conditions. This evidence also suggests that financial statement users may be able to use the consistency exception as a signal for bankruptcy.

The "Subject-To" Opinion

When an auditor encounters a situation in which the outcome of a matter cannot be reasonably estimated at the time the financial statements are issued, and believes the resolution of the matter would have had a material effect on the present financial statements had its outcome been known, the auditor should issue a subject-to opinion [AICPA, 1987, sec. 509.21-.26]. That is, the auditor states that the financial statements fairly present the results "subject to" the effects of the uncertainty. Examples of uncertainties include the recoverability of a deferred cost, litigation or income tax uncertainties, realizability of specific assets, and, of course, the general uncertainty of whether an entity will continue in existence.

We are aware of no research that has studied the relation between bankruptcy and qualifications for uncertainties made for other than going-concern reasons. Such uncertainties could be classified under the category of "contrary information" items that may cast doubt on the presumption under GAAP of an entity's ability to continue in existence as described in SAS No. 34 [AICPA, 1987, sec. 340.04]. Therefore, material uncertainties are possible precursors to general going-concern uncertainties and likely occur more often in bankrupt firms than in nonbankrupt firms. This implies that financial statement users may find the subject-to opinion useful as a warning signal for bankruptcy.

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from the auditor's report until research can demonstrate that eliminating the reference has no significant detrimental effect on the ability of the auditor's report to provide important signaling information to users [Holstrum, 1988]. SAS No. 58 [AICPA, 1988a] entitled, *Reports on Audited Financial Statements*, deletes any reference to consistency from the opinion paragraph but requires that an explanatory paragraph follow the opinion paragraph when GAAP has not been consistently applied.

The Going-Concern Opinion

When there are doubts about the continued existence of an entity, an auditor should consider issuing a going-concern opinion [AICPA, 1987, sec. 340].[6] This is a special type of the subject-to opinion which indicates that the auditor believes the financial statement results to be fairly presented "subject to" the resolution of the going-concern uncertainties.

Altman and McGough [1974] found that 46.4 percent of their sample of bankrupt companies had received the going-concern opinion one year prior to the bankruptcy event. Deakin [1977] examined cases two years prior to the bankruptcy event and found that 14.9 percent of the bankrupt companies had received the going-concern opinion. Altman [1982] found that 48.1 percent of his companies that went bankrupt during the 1970–1982 period had received the going-concern qualification one year prior to bankruptcy. Menon and Schwartz [1986] found that 43 percent of their companies that had entered bankruptcy during the 1974–1983 period had received the going-concern qualification one year prior to bankruptcy.

All of the above studies focused on the proportion of bankrupt companies that received a going-concern qualification. Altman [1982] also approached the issue differently through a more general sample of companies that received the going-concern opinion during the 1972–1978 period. Only 25 percent of his companies had filed a bankruptcy petition by 1979.[7] These results suggest that it is more likely for a going-concern recipient to be nonbankrupt. However, the large proportion of nonbankrupt to bankrupt companies and the relative rarity of the going-concern opinion itself suggest that bankrupt companies are more likely to receive the qualification[8] and that the going-concern opinion is useful as a warning signal for bankruptcy.

II. HYPOTHESIS DEVELOPMENT AND RESEARCH METHOD

The objective of this research is to assess whether consistency and uncertainty qualifications individually or jointly are useful predictors of bankruptcy for financial statement users. The exact form(s) of the model(s) used by those who rely on financial statements is unknown. Accordingly, one univariate and two multivariate log-linear models are developed. These are discussed below. In addition, tests of the predictive ability of the models provide a cross-validation of the log-linear analysis.

In contrast to likelihood-ratio tests of the coefficients in the log-linear model, predictive-ability tests are dependent on the choice of the cutoff point (usually based on priors and/or cost/benefit considerations) used to classify observations. Since financial statement users may operate under different priors or cost/benefit considerations, the predictive-ability tests were based on various levels of costs for Type I versus Type II errors.

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[6] SAS No. 59, *The Auditor's Consideration of an Entity's Ability to Continue as a Going Concern*, supersedes SAS No. 34 and requires the auditor to consider continued existence of an entity in all engagements. In addition, SAS No. 59 eliminates the "subject-to" qualification but requires the auditor to modify the report when substantial doubt exists about an entity's ability to continue in existence [AICPA, 1988b, par. 12].

[7] Altman does not provide information on frequencies by years, so it is not possible to tell from his data how many of the 25 percent were received one year prior to bankruptcy, etc.

[8] The bankrupt companies in the 1974–1981 period in this study represent about .5 percent of the population of interest each year. During a one-year period, Mutchler [1985] found that five percent of the manufacturing population, which included NYSE, ASE, and over-the-counter companies, had received the going-concern opinion. Note that the sample used in the research described herein consists of only NYSE and ASE companies. Thus, it would be expected that the occurrence of the going-concern opinion would be even more rare.

Log-Linear Analysis

Log-linear analysis is a general term given to a variety of techniques of model fitting, hypothesis testing, and parameter estimation for models that have categorical variables as major components. A variety of techniques are subsumed under log-linear analysis including general models of multi-way contingency tables and logistic regression analysis. The general-linear-model approach is advantageous since it incorporates a wide range of likelihood-ratio tests such as those typically used in regression and analysis of variance. The present study uses the standard likelihood-ratio tests. Specifically, individual model coefficients are tested. As is well-known, the test of the regression coefficients for a particular variable is mathematically equivalent to the test of the effect of adding that variable to the regression model; hence, it is a test of the incremental explanatory power.

The Univariate Model

The univariate model, as formulated below, tests the association between bankruptcy and a single opinion type. The univariate model reflects a situation in which, for example, a financial statement user views the consistency exception or the subject-to opinion as irrelevant to bankruptcy and, therefore, focuses on only the going-concern opinion. The model, formally stated for each of the opinion types, is as follows:

$$\ell n \frac{p(B|C)}{p(NB|C)} = a + b_1 C \quad (1a)$$

$$\ell n \frac{p(B|ST)}{p(NB|ST)} = a + b_2 ST \quad (1b)$$

$$\ell n \frac{p(B|GC)}{p(NB|GC)} = a + b_3 GC \quad (1c)$$

where

ℓn = The natural log,
B = Bankruptcy,
NB = Nonbankruptcy,
C = Consistency exception,
ST = Subject-to opinion,
GC = Going-concern opinion,
a = Intercept, and
$b_i, i = 1,3$ = Audit opinion coefficients.

The ratio on the left-hand side is the log-odds ratio where the numerator is the probability of a particular company falling into the bankruptcy group given one of the opinion types. The denominator is the probability of a particular company falling into the nonbankrupt group given the same opinion type. On the right-hand side, *C*, *ST*, and *GC* represent 0,1 indicator variables. Note that the coefficients will equal zero when the odds ratio (without logging) equals one (since $\ell n\ 1 = 0$). An odds ratio of one means that given knowledge of the audit opinion, the probability of a company falling into the bankrupt group is the same as the probability of a company falling into the nonbankrupt group. Hence, such an opinion is not associated with the probability of bankruptcy.

The coefficients are estimated using the logistic-regression approach[9] and the following null hypotheses are tested:[10]

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[9] The logistic regression form of the model can be derived by solving the log-linear model for the numerator of the log-odds ratio. Its general form is as follows:

$$P(B|C) = \frac{\exp(a + b_i x_i + \ldots + b_n x_n)}{1 + \exp(a + b_i x_i + \ldots + b_n x_n)}.$$

The parameters were estimated using the SAS Logist procedure [Harrell, 1983].

[10] These hypotheses are derived and stated as one-tailed because of the theoretical basis for the stated direction. The empirical tests employed, however, do not provide a direct test of one-tailed hypotheses. The alpha levels shown are for two-tailed hypotheses and, therefore, constitute a conservative (less likely to reject) test of the one-tailed hypotheses given.

$H01_a$: $b_1 \leq 0$
$H01_b$: $b_2 \leq 0$
$H01_c$: $b_3 \leq 0$

The tests of the audit opinion coefficients in the univariate model are tests for the difference in proportions between the bankrupt and nonbankrupt groups. Again, this univariate model assumes that a financial statement user focuses on only one opinion and ignores the others. The next subsection discusses two multivariate models. In the first model the audit opinion variables are tested for association with bankruptcy. In the second model both the audit opinion variables and financial ratios are tested for association with bankruptcy.

The Multivariate Models

The first multivariate model, which was used to test for the ability of the three opinion types to serve as a joint warning signal for bankruptcy is as follows:

$$\ell n \frac{p(B|C,ST,GC)}{p(NB|C,ST,GC)} = a + g_1C + g_2ST + g_3GC \qquad (2)$$

where the variables are defined as in the univariate model, and $g_i, i=1,3$ are coefficients estimated by the logistic-regression approach when the opinion types are treated jointly. The following null hypotheses were tested:

$H02_a$: $g_1 \leq 0$
$H02_b$: $g_2 \leq 0$
$H02_c$: $g_3 \leq 0$.

The tests of the individual coefficients for the three opinion types measure the incremental explanatory power of each of the opinion types beyond that provided by the other two. Note that if the opinion types are actually independent in the sense that $p(A|B) = p(A)$ where A and B are two opinion types, then the tests of this multivariate model produce identical results to those of the univariate models. On the other hand, from a statistical perspective, if more than one opinion type has an independent effect, then the multivariate model should be preferred by a financial statement user since, in that case, the use of the univariate model would involve ignoring information. Thus, in addition to testing for incremental effects of the opinion types beyond that provided by the other two, this part of the analysis can also be viewed as a test of the usefulness of the univariate model.

Each of the above analyses assumes that the user looks to only the audit opinion for a bankruptcy signal. There has been considerable accounting research that has tested the ability of financial ratios to predict bankruptcy (see Zavgren [1983], Foster [1986], and Jones [1987] for reviews). Financial statement users may, in fact, incorporate such ratios in their decision models. Accordingly, a second multivariate model incorporating financial ratios was developed and tested.

As stated above, many ratio models have been developed for the purpose of predicting bankruptcy. The research described in this paper is not designed to improve on past bankruptcy-prediction models. It is important, however, that the ratio model chosen performs well so results on tests of the audit opinion variables will not be biased. Zmijewski [1984a] compared 13 bankruptcy-prediction models including those based on financial statement data, those based on stock-return data, and those based on liquidity statistics. His results indicate that those based primarily on financial-statement-derived relations were more appropriate models for estimating bankruptcy probabilities and were the best predictors. In addition, he found that the estimated bankruptcy probabilities were generally correlated with one another across the models. He conducted an analysis across varying costs of Type I to Type II errors and concluded that differences among the financial-statement-based models were relatively small. In other research, Zmijewski [1984b] identified the return-on-assets, leverage, and liquidity financial dimensions as important in bankruptcy prediction.

The bankruptcy prediction model chosen for use in this research is composed of the following ratios:

Net Income/Total Assets	(NITA)
Current Assets/Total Assets	(CATA)
Current Assets/Current Liabilities	(CURRAT)
Cash/Total Assets	(CASHTA)
Current Assets/Sales, and	(CASALES)
Long-Term Debt/Total Assets	(LTDBTTA).

These six ratios are derived from the Beaver [1966], Deakin [1972], and Libby [1975] studies and can be viewed either as a subset of the Beaver and Deakin models or as the Libby model augmented with the Long-Term Debt to Total-Assets leverage ratio. This set includes the return-on-assets, the leverage, and the liquidity financial dimensions chosen by Zmijewski [1984b] because of their performance in other bankruptcy prediction research. Indications from previous research are that this model is sufficient for the intended use herein.[11]

The second multivariate model tested was as follows:

$$\ell n\frac{p(B\,|\,R_{i,i=1,6},C,ST,GC)}{p(NB\,|\,R_{i,i=1,6},C,ST,GC)} = a+h_1R_1+\ldots+h_6R_6 + h_7C+h_8ST+h_9GC \qquad (3)$$

where terms are as defined previously, and $h_{i,i=1,9}$ are coefficients estimated by the logistic-regression approach, and $R_{i,i=1,6}$ are the ratios as described above.[12]

The hypotheses tested with this second multivariate model were:

H03$_a$: $h_7 \leq 0$
H03$_b$: $h_8 \leq 0$
H03$_c$: $h_9 \leq 0$.

In this case a significant opinion coefficient means that the opinion has incremental explanatory power relative to the other opinions and also relative to the financial ratios. Again, the decision model(s) used by those who rely on financial statements is unknown. However, if tests of this multivariate model demonstrate explanatory power for at least one variable from the three audit opinion types and at least one from the ratio data set, then this model would be preferred over models (1) and (2).

The tests of the regression coefficients described above examine the importance of the related variables in explaining the probability of bankruptcy, but rejections of those null hypotheses do not guarantee that these variables will improve the predictive ability of the models. The next section examines the importance of these variables in improving predictive accuracy while taking into account varying ratios of costs for Type I versus Type II errors.[13]

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[11] We also tested the six-ratio model used by Beaver [1966]. That model consisted of the following ratios: cash flow to total debt, net income to total assets, total debt to total assets, working capital to total assets, the current ratio, and the no-credit interval. The results from the use of that model were essentially the same as those reported herein.

[12] Interactions terms are not included here because there is no theoretical reason to include them.

Prediction Analysis and Cost Considerations

We compare the predictive accuracy of three models: (1) the model containing only the audit opinion variables, (2) the model containing only the ratios, and (3) the model containing both the ratios and the audit opinion variables. Tests are formally conducted on the increase in predictive accuracy related to the adding of audit opinion variables to the ratio model. The analysis is conducted across varying ratios of the costs of Type I versus Type II errors. In addition, the results are compared to the naive model which predicts all observations nonbankrupt. The following null hypothesis was tested:

H04: $PA_{R+A} \leq PA_R$

where

PA_R = Predictive accuracy of the model with only the ratios, and

PA_{R+A} = Predictive accuracy of the model with both ratios and the audit-opinion variables.

Predictive accuracy is measured through the use of chronological predictions based on a holdout sample from a later time period.

For each of the cost ratios discussed below, the bankruptcy probability distribution based on the estimation sample is used to determine the optimal cutoff probability to be used to predict companies in the holdout sample. The optimal cutoff probability, of course, is that which produces the lowest misclassification cost. The range of Type I/Type II cost ratios used was 1:1, 10:1, 20:1, 30:1, 40:1, and 50:1. Although it is unlikely that a decision maker would have symmetrical cost preferences, the 1:1 ratio is included for comparison purposes because many previous research studies have used this ratio. The others were chosen as representative of a wide range of cost considerations, and include those used by Zmijewski [1984a] and Dopuch et al. [1987].

The expected total costs of misclassification, ignoring information analysis costs is:

$$EC=(a)P_I C_I+(1-a)P_{II} C_{II}, \quad (4)$$

where

a = probability of bankruptcy (B), or $p(B)$,

$1-a$ = probability of nonbankruptcy (NB), or $p(NB)$,

P_I = probability of predicting NB given B, or $p(NB|B)$,

P_{II} = probability of predicting B given NB, or $p(B|NB)$,

C_I = cost of predicting NB given B, and

C_{II} = cost of predicting B given NB.

The objective is to choose a cutoff point such that costs will be minimized given the various cost ratios. Taking into account the population proportions discussed below, the calculated cutoff points are .5, .091, .048, .032, .024, and .020 for the 1:1 through the 50:1 cost ratios, respectively. These cutoff points were used to produce sets of predictions corresponding to the various cost ratios.

Sample and Data Collection Techniques

To find a sample of bankrupt companies for our estimation sample, *The*

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[13] As used in this research, Type I error is a bankrupt company predicted as nonbankrupt and Type II error is a nonbankrupt company predicted as bankrupt.

Wall Street Journal Index was searched for companies listed on either the New York or American Stock Exchanges appearing under the heading "Bankruptcies" for the years 1974 through 1981. One hundred twenty-six companies were found, and 89 appeared on the COMPUSTAT Annual Industrial File. Deletion of firms with insufficient data to compute the financial statement ratios described above resulted in a total number of bankrupt companies in the estimation sample ranging from 60 to 64 depending on the year.[14] Next, a control group of 55 nonbankrupt companies for the estimation sample was randomly selected (subject to data availability)[15] within the same time frame.

The same procedure was followed in determining a sample of bankrupt and control companies for the holdout period from 1982–1985. The holdout sample consisted of 32 bankrupt and 32 nonbankrupt companies from that time period.[16]

All predictions incorporated the use of population priors. The population proportion of bankrupt companies was based on the population of companies from which the sample was chosen. The bankruptcy rate is .49 percent, and is based on the average (over the time period of interest) proportion of firms which were both on COMPUSTAT and listed on either the New York or American Stock Exchanges on December 31 of one year and which went bankrupt the following year.

The year immediately preceding bankruptcy ($Y-1$) was the year for which the last full set of financial statements (prior to the bankruptcy date) was filed with the SEC. Data on the audit opinions were gathered from either 10-K reports available in various university libraries or from audit opinion copies received from Disclosure Inc. Opinions were classified as going-concern opinions if the auditor either disclaimed an opinion or expressed doubt about the company's ability to survive as a going-concern. Opinions were also classified as going-concern if the auditor either expressed doubt about the company's ability to finance its future operations or expressed doubt about the "recoverability and classification of assets and the amounts and classification of liabilities" without reference to the company's ability to continue in existence. Opinions were classified as subject-to opinions if they referred to a specific uncertainty such as an unresolved lawsuit, a realizability question for a specific asset, or an unresolved tax matter.

Opinions were classified as consistency exceptions only if they related to voluntary and non-LIFO related accounting changes. Any other consistency exceptions were classified as unqualified opinions. This is consistent with Schwartz [1982], and is based on the argument that mandatory and LIFO-related accounting changes are not evidence of creative accounting.

III. RESULTS

Results are presented in this section for each of the five years prior to bankruptcy. Formal hypothesis testing is limited to the year immediately preceding bankruptcy due to concerns about independence of the tests if conducted in more than one year. There is research indicating a dependency between qualified opinions across time [Tackett, 1982; Mutchler, 1984] in the sense that once the opinion is qualified, the auditor is reluctant to remove the qualification even with improving conditions in the case of the going-concern audit report. Hypothesis testing in each of the five years preceding bankruptcy would ignore that dependency. This research is concerned with the association between bankruptcy and qualified opinions, and differences between the bankrupt and nonbankrupt groups should be at a maximum in the year immediately preceding bankruptcy. While the formal hypotheses are tested in terms of $Y-1$, observed significance levels are also presented for $Y-2$ through $Y-5$ for descriptive purposes. It is plausible that economic events leading to bankruptcy are correlated with factors leading to the various qualifications, and this association may exist for more than one year prior to bankruptcy. Therefore, results for $Y-2$ through $Y-5$ should provide information about such a correlation.[17]

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[14] Some companies did not have complete data across all five years. Those companies that had complete data for at least one of the years was kept in the sample, thus the unequal number across the years. Some data items were retrieved from 10-Ks for a few bankrupt firms where COMPUSTAT did not report the data.

[15] The random selection was made from a list of all nonbankrupt companies that met the data and listing requirements.

[16] There is no need for the sample to be proportional to the population proportions (see Maddala [1983, pp. 90–91]).

Descriptive Information

Tables 1 and 2 present information on the reasons for the consistency exceptions and subject-to opinions, respectively. As shown in Table 1, all of the accounting changes in revenue recognition across the five years prior to bankruptcy were made by the bankrupt companies. All of these changes involved a change in accounting from the cash to the accrual method, reportedly to achieve a better matching of revenues and costs. Each of the changes in revenue recognition led to a decrease in reported income in the year of change. The majority of the changes in accounting for various assets (e.g., tools, machinery, etc.) related to the bankrupt companies. All of these changes were from expensing to capitalizing the assets, and again the argument was presented that a better matching of revenues and costs would be achieved. The effect on income was mixed, with some changes increasing income in the year of change, with some decreasing, and with some having no effect. Contrary to expectations, these data provide no consistent evidence of accounting changes to increase reported income.

The data are, however, consistent with the argument that when faced with a client whom the auditor believes is likely to fail, the auditor may insist on improved accounting. This insistence may be due to the belief that the auditor's liability will be less if "preferable" accounting methods have been used by the failed company. Such a "get tough" attitude for weak clients is consistent with the recent paper on subject-to opinions by Dopuch et al. [1987] and a paper on the characteristics of companies correcting previously reported quarterly earnings by Kinney and McDaniel [1988]. The Dopuch et al. results indicate that the probability of a first time "subject-to" opinion is negatively correlated with stock returns and positively correlated with accounting losses for the audit year. Kinney and McDaniel's results indicate that companies correcting previously reported quarterly earnings are, relative to their industry, smaller, less profitable, have higher debt, are slower growing, and face more serious uncertainties. The average stock return for the period between the issuance of

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[17] It also seems likely that the auditor focuses on a one-year time horizon since they will audit again one year later. This is supported by SAS No. 59, which states that "The auditor has a responsibility to evaluate whether there is substantial doubt about the entity's ability to continue as a going-concern for a reasonable period of time, not to exceed one year beyond the date of the financial statements being audited" [AICPA, 1988b, par. 2].

TABLE 1

ONE THROUGH FIVE YEARS PRIOR TO BANKRUPTCY: NUMBER OF CONSISTENCY EXCEPTIONS FOR BANKRUPT VERSUS NONBANKRUPT FIRMS BY TYPE OF ACCOUNTING CHANGE AND EFFECT OF CHANGE ON INCOME

	Years Before Bankruptcy									
	5		*4*		*3*		*2*		*1*	
	B*	NB	B	NB	B	NB	B	NB	B	NB
Changes in method of accounting for:										
Non-LIFO inventory	1		1		1	2		2	1	1
Investments	2	1	2	1			1	1	1	1
Product warranty costs			1			1				1
Pension costs			1				1			
Depreciation			1	1	1		1	1	2	
Investment tax credit		1		1					1	
Revenue recognition (from cash to accrual)	2				2		3		3	
Tax loss carry forward					1					
Various assets (from expensing to capitalizing)	3			1	1		2		1	
Deferred income tax									1	
Discontinued operations					1		1			
Total Number of Consistency Exceptions	8	2	6	4	7	3	9	4	10	3
Effect of changes above on income:										
Income increasing	3	2	0	2	5	2	4	3	3	2
Income decreasing	4	0	5	2	2	1	4	1	3	0
No effect	1	0	1	0	0	0	1	0	4	1

* *B* = Bankrupt companies
NB = Nonbankrupt companies

erroneous quarterly reports and their corrections is negative. Kinney and McDaniel suggest as a possible explanation for their results that the auditor observes stock price declines in conjunction with declining earnings and extends the audit (increasing the probability of discovering errors) or decides to require correction of any known misstatements.

The difference between these results and those of Schwartz [1982] may be due to sample differences and/or to the definition of materiality. Schwartz had a sample of financially distressed companies that included, but was not limited to, bankrupt companies. In the present research the sample of distressed companies was confined to firms that had already filed for bankruptcy. In addition, as reported earlier, Schwartz's definition of a material accounting change differed from that used in this research since his definition was made without regard to the auditor's opinion. In the present research, accounting changes were related only to the receipt

TABLE 2
ONE THROUGH FIVE YEARS PRIOR TO BANKRUPTCY: NUMBER OF SUBJECT-TO OPINIONS FOR BANKRUPT VERSUS NONBANKRUPT FIRMS BY TYPE OF UNCERTAINTY

	Years Before Bankruptcy									
	5		*4*		*3*		*2*		*1*	
Type of Uncertainty	B*	NB	B	NB	B	NB	B	NB	B	NB
Adequacy of loss provision	2		2	1	2		3		4	1
Resolution of tax matter	1		2				1		1	
Negotiations with banks				1			1		1	
Litigation	2	1	2	1	3	1	4	2	9	1
Realization of specific assets	2	1	5	2	7	1	7	1	10	1
Total Number of Subject-to Opinions	7	2	11	5	12	2	16	3	25	3

* *B*=Bankrupt companies
NB=Nonbankrupt companies

of the consistency exception (i.e., with materiality defined by the auditor).

Table 2 presents an analysis of the types of subject-to opinions across the bankrupt and nonbankrupt categories for the five years preceding bankruptcy. The most common subject-to qualifications in the bankrupt category were, not surprisingly, those for litigation and those for realization of specific assets. The assets most often cited were accounts receivable, inventories, and investments. In the year immediately preceding bankruptcy, the litigation uncertainty qualification occurred more often in the bankrupt category than in the nonbankrupt category, thus, indicating "contrary information" as discussed in SAS No. 34.

For each of the five years preceding bankruptcy, Table 3 presents the proportion of companies in the bankrupt and nonbankrupt categories that received each of the qualifications or any qualification in general. In addition, the differences in proportions of bankrupt versus nonbankrupt companies is presented for each category. For example, in $Y-1$ the bankrupt companies received 10.7 percent more consistency exceptions, 34.9 percent more subject-to opinions, 38.7 percent more going-concern opinions, and 55.2 percent more qualified opinions in general than did nonbankrupt companies.

The Fisher's exact probability test results are presented here for descriptive purposes.[18] The tests presented in Table 3 are equivalent to the tests of the coefficients of the univariate model presented in Table 5. However, Fisher's exact test applies only to the one-factor situation and, thus, cannot be used to test the multivariate models. Therefore, the Fisher's exact test results are presented here for descriptive purposes, and con-

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[18] With Tocher's modification, Fisher's exact probability test is the most powerful of the one-tailed tests for data of this kind [Siegel, 1956, pp. 96–104]. As the sample size increases, the results of the single-cue log-linear model will asymptotically approach those from Fisher.

TABLE 3

ONE THROUGH FIVE YEARS PRIOR TO BANKRUPTCY: PROPORTION OF QUALIFICATIONS FOR BANKRUPT VERSUS NONBANKRUPT COMPANIES BY TYPE OF OPINION QUALIFICATION

	Years Before Bankruptcy	*B*†	*NB*	*B−NB*	*Fischer's Exact Probability*
Consistency					
	−5	13.3	3.6	9.7	0.063*‡
	−4	9.7	7.3	2.4	0.450
	−3	10.9	5.5	5.5	0.231
	−2	12.5	7.3	5.2	0.264
	−1	16.1	5.5	10.7	0.060*
Subject-to					
	−5	11.7	3.6	8.0	0.104
	−4	17.7	9.1	8.7	0.138
	−3	18.8	3.6	15.1	0.010***
	−2	23.4	5.5	18.0	0.005***
	−1	40.3	5.5	34.9	0.000***
Going-concern					
	−5	1.7	0.0	1.7	0.522
	−4	1.6	0.0	1.6	0.530
	−3	4.7	0.0	4.7	0.152
	−2	15.6	0.0	15.6	0.001***
	−1	38.7	0.0	38.7	0.000***
Any Qualification					
	−5	21.7	7.3	14.4	0.026***
	−4	24.2	16.4	7.8	0.207
	−3	28.1	9.1	19.0	0.007***
	−2	37.5	12.7	24.8	0.002***
	−1	66.1	10.9	55.2	0.000***

† *B*=Bankrupt companies
NB=Nonbankrupt companies
B−NB=Difference: Bankrupt minus Nonbankrupt companies
‡ Significance for tests of coefficients:
* ≡$\alpha<.10$
** ≡$\alpha<.05$
*** ≡$\alpha<.01$

sistency was followed in testing the coefficients for the univariate and multivariate models.

Bankrupt companies were significantly more likely to receive a qualified opinion of any type in the year immediately preceding bankruptcy. In fact, bankrupt companies received more qualified opinions in each of the five years preceding bankruptcy. The pattern of increasing numbers of qualifications for the bankrupt companies as the bankruptcy event approaches can clearly be seen for the subject-to and going-concern opinions. This same pattern did not hold for consistency exceptions, although in each year bankrupt companies received more of this type of qualification than did the nonbankrupt companies.

TABLE 4

ESTIMATES OF THE *R*s AND LOGIT COEFFICIENTS AND THEIR TESTS FOR THE UNIVARIATE MODEL

$$\ell n \frac{p(\text{Bankruptcy}\,|\,\text{Qualification}_i)}{p(\text{Nonbankruptcy}\,|\,\text{Qualification}_i)} = a_i + b_i\text{Qualification}_i$$

	Years Before Bankruptcy				
	5	*4*	*3*	*2*	*1*
Consistency qualification					
Model *R*	0.10*	0.00	0.00	0.00	0.10**
Coefficients:					
a_1 (Intercept)	−0.02	0.09	0.09	0.09	0.00
b_1 (Consistency)	1.41*	0.31	0.76	0.60	1.20**
Subject-to qualification					
Model *R*	0.07*	0.00	0.18***	0.20***	0.35***
Coefficients:					
a_2 (Intercept)	0.00	0.02	−0.02	−0.06	−0.34
b_2 (Subject-to)	1.25*	0.77	1.81***	1.67***	2.46***
Going-concern qualification					
Model *R*	0.00	0.00	0.10**	0.26***	0.46***
Coefficients:					
a_3 (Intercept)	0.07	0.10	0.10	−0.02	−0.37*
b_3 (Going-concern)	6.13	6.10	7.11**	9.23***	9.58***

* $\equiv \alpha < .10$
** $\equiv \alpha < .05$
*** $\equiv \alpha < .01$

Univariate and Multivariate Models

Results of the univariate model logistic-regression analysis are presented in Table 4. The model *R* is a measure of the predictive ability of the model, and is similar to the multiple correlation coefficient, given that a correction has been made to adjust for the number of parameters estimated. It is the value such that:

$$R^2 = (\text{model } \chi^2 - 2p)/(-2L(0)) \quad (5)$$

where

p = the number of variables in the model excluding the intercept, and

$L(0)$ = the maximum log likelihood with only an intercept in the model.

Note that *R* will not necessarily increase in magnitude when variables are added to the model; each added variable must increase the model χ^2 by more than an average of two for *R* to increase [Harrell, 1983, pp. 182–185].

In Table 4, the model *R* is significant for each of the opinion types for the year immediately preceding bankruptcy. Likewise, the coefficients for each of the opinion types is significant in $Y-1$. This evidence is consistent with the hypothesis that these qualifications can serve as a signal for bankruptcy.

TABLE 5

ESTIMATES OF THE *R*s AND LOGIT COEFFICIENTS AND THEIR TESTS FOR THE AUDIT-OPINION-ONLY MODEL

$$\ell n\frac{p(\text{Bankruptcy}\mid\text{Qualifications})}{p(\text{Nonbankruptcy}\mid\text{Qualifications})}=a+g_1C+g_2ST+g_3GC$$

	Years Before Bankruptcy				
	5	*4*	*3*	*2*	*1*
Model *R*	0.00	0.00	0.16	0.25***	0.53***
Coefficients:					
a (Intercept)	−0.09	0.00	−0.10	−0.20	−0.86***
g_1 (Consistency or C)	1.25	0.29	0.71	0.38	0.97
g_2 (Subject-to or ST)	1.07	0.66	1.60**	1.35**	2.31***
g_3 (Going-concern or GC)	3.97	5.55	6.44	8.81***	10.22***

* $\equiv\alpha<.10$
** $\equiv\alpha<.05$
*** $\equiv\alpha<.01$

Table 5 presents results for the multivariate model in which the incremental explanatory power of each opinion type is tested relative to the other opinions. The tests of the coefficients in $Y-1$ indicate that the subject-to opinion and the going-concern opinion have incremental explanatory power beyond that provided by the other opinion types. There is no evidence that the consistency exception has incremental explanatory power. Again, this evidence indicates nonindependence across the opinion types. Overall, the evidence suggests that the multivariate model provides more useful information than that provided by the univariate model. In particular, it implies that users of financial statements interested in assessing bankruptcy risk should consider both the subject-to and going-concern opinions, and that focusing on the going-concern opinion alone would be suboptimal.

Table 6 presents results for the multivariate model which includes both the ratio data and each opinion type. Model estimates for the ratio-only model are provided for comparison purposes. The model *R*s were significant for both of the models in the year immediately prior to bankruptcy. A comparison of the *R*-value in Table 6 with the *R*-value of the audit opinion model in Table 5 indicates that both of the models in Table 6 have higher explanatory power in $Y-1$. The ratio-plus-audit-opinion model has the highest explanatory power. The incremental χ^2 represents the difference between the value obtained by testing the model containing the ratios and audit opinion variables, and the value obtained by testing the model with only the ratios. Note that value is significant in $Y-1$. This indicates a significant incremental explanatory effect for the audit qualifications as a group.

In the year immediately preceding bankruptcy, both the consistency exception and the going-concern opinions indicate incremental explanatory effects beyond the explanatory effects jointly provided by the other opinions and the ratios. This indicates that the model containing both the audit opinions and the ratios should be preferred by a financial statement user, and it also sug-

TABLE 6

ESTIMATES OF THE *R*S AND LOGIT COEFFICIENTS, AND THEIR INCREMENTAL TESTS FOR THE RATIOS-ONLY MODEL VERSUS RATIOS-PLUS-AUDIT-OPINION MODEL

Panel A: Ratios-Only Model

$$\ell n\frac{p(\text{Bankruptcy}\,|\,\text{Ratios})}{p(\text{Nonbankruptcy}\,|\,\text{Ratios})}=a+h_1R_1+h_2R_2+h_3R_3+h_4R_4+h_5R_5+h_6R_6$$

	Years Before Bankruptcy				
	5	*4*	*3*	*2*	*1*
Model *R*	.46***	.41***	.41***	.57***	.65***
Coefficients:					
a (Intercept)	0.25	0.49	−1.72	−2.88**	−0.80
h_1 (Net Income/Total Assets)	−36.62**	−30.43***	−16.59***	−20.85***	−32.36***
h_2 (Current Assets/Sales)	2.22**	1.57	2.80**	2.81**	0.55
h_3 (Current Ratio)	−0.49***	−0.32***	−0.44***	−0.57***	−0.07
h_4 (Current Assets/Total Assets)	1.89	1.13	2.03	3.44**	1.42
h_5 (Cash/Total Assets)	7.27	5.68	3.23	5.94	−7.45
h_6 (Long-term Debt/Total Assets)	−0.22	−0.62	3.92**	5.47**	2.70

Panel B: Ratios- and Audit-Opinion Model

$$\ell n\frac{p(\text{Bankruptcy}\,|\,\text{Ratios})}{p(\text{Nonbankruptcy}\,|\,\text{Ratios})}=a+h_1R_1+h_2R_2+h_3R_3+h_4R_4+h_5R_5+h_6R_6+h_7C+h_8ST+h_9G$$

	Years Before Bankruptcy				
	5	*4*	*3*	*2*	*1*
Incremental χ^2 to model above	.41	5.38	8.25**	5.45	15.87***
Model *R*	.41***	.41***	.43***	.56***	.69***
Coefficients:					
a (Intercept)	0.20	0.55	−2.06*	−3.91***	−3.28**
h_1 (Net Income/Total Assets)	35.61***	−24.90***	−12.51**	−20.58***	−30.84***
h_2 (Current Assets/Sales)	2.23**	1.19	2.92**	2.50**	−1.66
h_3 (Current Ratio)	−0.50**	−0.88***	−0.95***	−0.54***	0.04
h_4 (Current Assets/Total Assets)	1.93	2.63*	3.53**	4.80***	5.13**
h_5 (Cash/Total Assets)	6.76	7.67	4.18	5.52	−10.99
h_6 (Long-term Debt/Total Assets)	−0.45	−0.02	4.82**	6.05**	4.62
h_7 (Consistency)	0.16	−0.05	0.33	1.08	2.50**
h_8 (Subject-to)	0.54	−0.30	0.70	−0.10	1.02
h_9 (Going-concern)	1.38	22.97**	21.18**	7.51*	11.40***

* $\equiv\alpha<.10$
** $\equiv\alpha<.05$
*** $\equiv\alpha<.01$

gests possible improvement of predictive accuracy.

Predictive Ability and Sensitivity to Misclassification Costs

The predictive accuracies of the three models and that of the naive model are compared across the various cost ratios. The models tested in this manner include the model with only the audit opinions, the model with only the ratios, the model with both the ratios and the audit opinions, and the naive model which simply predicts all observations as nonbankrupt. Given the proportion of bankrupt companies in the population of interest, the naive model predicts with 99.51 percent overall accuracy with, of course, 100 percent accuracy in the nonbankrupt group and zero percent accuracy in the bankrupt group.

Table 7 presents the predictive-accuracy analysis for each of the five years preceding bankruptcy and for each of the cost ratios. The McNemar test is used to assess the significance of the change in predictive accuracy resulting from the addition of the audit opinion variables to the ratio model.[19] It is clear that the audit-opinion variables have significant predictive power beyond the ratios in $Y-1$ across all of the cost ratios tested. For each of the cost ratios, the addition of the audit opinion to the ratios significantly increased the predictive accuracy for the bankrupt companies. In $Y-1$ the accuracy of the ratio model increased by 31.2, 21.8, 21.8, 21.9, 18.8, and 25.0 percentage points with the addition of the audit-opinion variables for the 1:1, 10:1, 20:1, 30:1, 40:1, and 50:1 cost ratios, respectively. In addition, the audit-opinion variables provide evidence of significant incremental predictive power in $Y-2$ under the symmetrical cost (i.e., 1:1) assumption: the predictive accuracy of bankrupt companies is increased from 0.0 percent to 15.6 percent.

In general, for the last three years prior to bankruptcy, the audit-opinion-only model provides the lowest misclassification costs. Beyond three years prior to bankruptcy, it is difficult to beat the naive strategy of predicting all observations as nonbankrupt. Note that in $Y-1$, the prediction accuracy for the bankrupt companies is higher for the audit-opinion-only model than it was for the ratio-only model across all cost ratios. This evidence, along with the significant increase in predictive accuracy of the ratio model due to the addition of the audit-opinion variables, indicates that the audit opinion can serve as a red flag for the event of bankruptcy. These results are, of course, relative to the power of the bankruptcy prediction model used.

IV. SUMMARY AND CONCLUSIONS

This study investigated the usefulness of the audit opinion in providing incremental explanatory power for bankruptcy. Using the log-linear approach from the viewpoint of those who rely on financial statements, the incremental explanatory effects of the consistency exception, the subject-to opinion issued for other than going-concern reasons, and the going-concern opinion were investigated within the framework of one univariate and two multivariate models. Tests of the univariate model indicated incremental explanatory power for each opinion type. Tests of the first multivariate model which uses audit-opinion variables in conjunction with each other indicated incremental explanatory effects for both the going-concern and

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[19] The McNemar test is basically a binomial test against a null that changes in classification should be improvements with $p=.5$ [Siegel, 1956, pp. 63–67].

TABLE 7

PREDICTIVE-ACCURACY RESULTS (PERCENT CORRECT) AND THE COSTS OF MISCLASSIFICATION

Year	Cost Ratio	Opinion Only			Ratios Only			Ratio and Opinion			Naive Model Cost
		Percent Correct			Percent Correct			Percent Correct			
		NB	B	Cost	NB	B	Cost	NB	B	Cost	
Y−1	1	100.0	46.9	.003	100.0	18.8	.004	100.0	50.0***	.003	.005
Y−1	10	100.0	46.9	.026	100.0	31.3	.034	100.0	53.1***	.023	.049
Y−1	20	100.0	46.9	.053	96.9	31.3	.099	96.9	53.1***	.077	.099
Y−1	30	100.0	46.9	.079	96.9	34.4	.128	96.9	56.3***	.096	.148
Y−1	40	100.0	46.9	.105	96.9	37.5	.155	96.9	56.3**	.118	.198
Y−1	50	100.0	59.4	.100	96.9	37.5	.186	96.9	62.5***	.124	.247
Y−2	1	100.0	15.6	.004	100.0	0.0	.005	100.0	15.6**	.004	.005
Y−2	10	100.0	15.6	.042	96.9	12.5	.074	100.0	15.6	.042	.049
Y−2	20	100.0	15.6	.083	96.9	25.0	.105	96.9	25.0	.105	.099
Y−2	30	100.0	15.6	.125	93.8	37.5	.155	93.8	37.5	.155	.148
Y−2	40	100.0	15.6	.167	93.8	40.6	.180	93.8	37.5	.186	.198
Y−2	50	100.0	15.6	.208	84.4	43.8	.294	90.6	43.8	.232	.247
Y−3	1	100.0	9.4	.005	100.0	0.0	.005	100.0	9.4	.005	.005
Y−3	10	100.0	9.4	.045	100.0	0.0	.049	96.9	9.4	.076	.049
Y−3	20	100.0	9.4	.090	96.9	3.1	.127	96.9	12.5	.118	.099
Y−3	30	100.0	9.4	.134	96.9	6.3	.170	93.8	18.8	.183	.148
Y−3	40	100.0	9.4	.179	96.9	15.6	.198	93.8	21.9	.217	.198
Y−3	50	96.9	12.5	.247	96.9	18.8	.232	93.8	28.1	.240	.247
Y−4	1	96.9	3.1	.036	100.0	0.0	.005	96.9	3.1	.036	.005
Y−4	10	96.9	3.1	.079	96.9	0.0	.081	93.8	3.1	.110	.049
Y−4	20	96.9	3.1	.127	96.9	3.1	.127	90.6	12.5	.180	.099
Y−4	30	96.9	3.1	.175	93.8	6.3	.201	90.6	12.5	.223	.148
Y−4	40	96.9	3.1	.223	93.8	9.4	.241	87.5	15.6	.291	.198
Y−4	50	96.9	3.1	.270	90.6	12.5	.309	87.5	18.8	.325	.247
Y−5	1	100.0	0.0	.005	93.8	0.0	.067	93.8	3.1	.067	.005
Y−5	10	96.9	3.1	.079	93.8	9.4	.107	93.8	9.4	.107	.049
Y−5	20	96.9	3.1	.127	93.8	12.5	.149	93.8	12.5	.149	.099
Y−5	30	96.9	6.3	.170	93.8	12.5	.192	93.8	12.5	.192	.148
Y−5	40	96.9	6.3	.216	87.5	18.8	.285	87.5	15.6	.291	.198
Y−5	50	96.9	6.3	.263	87.5	18.8	.325	87.5	18.8	.325	.247

* $\equiv \alpha < .10$
** $\equiv \alpha < .05$
*** $\equiv \alpha < .01$

other subject-to opinions. When the opinion variables were tested in conjunction with financial ratios from a bankruptcy-prediction model, the consistency exception and the going-concern opinions had incremental explanatory power. These results indicate that these two opinions have unique explanatory effects beyond the ratios and other opinion variables.

A predictive accuracy analysis was also conducted to cross-validate the tests of the logistic-regression coefficients. In addition, tests of the sensitivity of the results to varying costs of Type I versus Type II error were included. The results indicated that the audit-opinion-only model is, in the majority of cases, the least-cost alternative (ignoring analysis costs) in the last three years prior to bankruptcy. In years $Y-4$ and $Y-5$, it is difficult to beat the naive strategy of predicting all companies as bankrupt. Overall, the results of the research provide credence to financial statement users' insistence that the qualified opinion has the ability to serve as an early-warning signal for entity failure.

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Firm-Size and the Predictive Ability of Quarterly Earnings Data

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ABSTRACT: We present evidence on inter-firm differences in the predictive ability of quarterly earnings data for a sample of 109 New York Stock Exchange firms. The sample consisted of large, medium, and small firms after deletion of nonseasonal and volatile growth and inconsistent strata membership firms. Although the structure of the best fitting time-series models was constant across firm-size strata, we did find significant differences in the autoregressive parameters of the Foster and Brown and Rozeff ARIMA models across firm-size strata. One-step-ahead quarterly earnings forecasts were generated by a set of best fitting time-series models. A repeated measure multivariate analysis of variance design indicated that predictive ability differed on the basis of size at the .012 level. Tests also indicated that large- and medium-size firms generated one-step-ahead forecasts that were significantly more accurate than smaller firms at the .05 level. We obtained similar predictive findings on the significance of the size-effect in a supplementary analysis of the nonseasonal and volatile growth and inconsistent strata membership firms.

THE time-series properties and predictive ability of quarterly earnings data have long been topics of interest to financial accounting researchers. The focus of early work in time-series research was on the development of parsimonious models for quarterly earnings such as those popularized by Foster [1977], Griffin [1977], Watts [1975], and Brown and Rozeff [1979]. Motivation for such time-series work has been the notion that a general form seasonal model, identified from cross-sectionally derived average sample autocorrelation functions (SACFs), is sufficiently robust to represent the quarterly earnings data of firms without resorting to more complex, firm-specific alternatives. However, more recent work by Lorek and Bathke [1984] provides evidence that the quarterly earnings of certain firms behave in a nonseasonal manner systematically different from that suggested by the parsimonious models.[1] This raises the issue of whether systematic differ-

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[1] All three parsimonious models contain either seasonal differencing and/or seasonal moving average parameters.

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ences exist across firms in either model structure, parameter values, or predictive ability. The objective of the present paper is to evaluate firm-size as an independent variable useful in isolating such inter-firm differences in quarterly earnings data.

We concentrate on firm-size for several reasons. First, theoretical and empirical work in accounting and finance has documented the importance of firm-size when testing the information in security prices with respect to future earnings [Collins et al., 1987]. It is reasonable to infer from these findings that the predictive ability of earnings numbers may be dependent on firm-size. Second, Foster et al. [1984] report that firm-size independently explains a substantial portion of the variation in postannouncement drifts in security returns due to potentially misspecified quarterly earnings expectation models. Third, Bamber [1986] reports that *Value Line* earnings-per-share forecasts are more accurate for large rather than small firms. Grant [1980] and Atiase [1985] also provide corroborative evidence suggesting that reduced levels of information are available for small firms. Additionally, less extensive coverage by financial intermediaries may also be partially responsible for the less accurate earnings predictions of smaller firms. Given the reduced availability of financial analyst forecasts for smaller firms, knowledge of the time-series properties of smaller firms is especially important. Although the results presented here indicate that firm-size does not affect the appropriateness of the choice of a common model structure, we did find significant differences in the autoregressive parameters of the Foster and Brown and Rozeff models as well as the predictive ability of quarterly earnings data for firms partitioned by size.

The current research has potential relevance to several related areas in financial accounting research. First, the findings may help explain some anomalies in extant time-series research in that we provide new evidence on the sensitivity of predictive ability to the firm-size effect. Second, controlling for differences in the time-series properties of quarterly earnings data for large and small firms may also help explain the systematic differences in risk adjusted security returns attributable to the firm-size effect. Since our identification and modeling procedures resulted in constant model structures across firm-size strata, it is unclear from our results whether capital market researchers should necessarily employ a separate analysis of small and large firms. What is germane is whether size is an important omitted explanatory variable in the context of a specific research design. Finally, if firm-size explains inter-firm differences in some of the parameter values of best-fitting time-series models, this should enhance basic understanding of the process generating quarterly earnings numbers.

We begin the paper with background on prior research followed by sections on the method used, sample profile analysis, descriptive analysis of the sample, modeling considerations, and predictive results. We close with some concluding remarks.

BACKGROUND

The present study focuses on what independent variable(s) help to explain inter-firm differences in quarterly earnings data. Our purpose is not to resolve the issue over which unique autoregressive-integrated-moving average (ARIMA) structure may be optimal for firms' quarterly earnings numbers.[2] In fact, lack of clear dominance across all studies and time periods of a singular (*pdq*) ×(*PDQ*) ARIMA structure may actually be symptomatic of uncontrolled variables in past research designs.

Scherer [1973] provides evidence that larger firms exhibit more stable and less volatile growth patterns than smaller firms perhaps due to their ability to diversify into several product lines and operations more readily. This may manifest itself in relatively higher levels of serial correlation in the quarterly earnings numbers of larger firms. Although Collins et al. [1987] were primarily interested in assessing the information in security prices with respect to the predictive ability of earnings, their finding that price-based-earnings forecasts outperform time-series forecasts by a greater margin for larger firms than smaller firms is of direct interest here. Their result implies that firm-size may help to explain inter-firm differences in the predictive ability of quarterly earnings data and helps to motivate the consideration of firm-size as an independent variable in the current study. Freeman [1987] also provides evidence that the magnitude of abnormal returns associated with good or bad news earnings signals is inversely related to firm-size. Freeman [p. 227] speculates that these findings might simply be due to differential time-series properties of the earnings numbers of large and small firms—an uncontrolled factor in his research design—and calls for future research to examine the possibility. The empirical evidence on the importance of the size-effect in the above settings, led us to consider whether controlling explictly for firm-size leads to inter-firm differences in predictive ability.

Although the empirical work on quarterly earnings data using time-series analysis has stressed seasonal ARIMA structures, Lorek and Bathke [1984] provided evidence that a subset of firms analyzed in previous time-series work exhibit virtually no seasonal characteristics. These findings suggest that the use of seasonal ARIMA models on such nonseasonal firms results in parameter redundancy, data overfitting, and a resultant decline in predictive ability. Therefore, we deleted such nonseasonal firms from our primary test sample to avoid introducing noise in the modeling process due to their unusual SACF patterns relative to seasonal firms. However, for completeness, we also provide profile information on the nonseasonal firms and examine the impact of firm-size on predictive ability for this nonseasonal subsample separately from the test sample.

Much of the earlier work on firm-size has been cross-sectional rather than time-series in nature with firm-size being measured by a proxy variable (typically, market value of equity) at a single point in time across all sample firms (e.g., see Lev [1983]). However, our identification data for quarterly earnings numbers spans 1967–1979. Rather than selecting a single point in time to measure firm-size, we measure the proxy variable at the beginning, middle, and end of the identification period. This allows us to assess

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[2] See Bao et al. [1983] for an extensive survey of time-series research in accounting. Briefly, several parsimonious autoregressive-integrated-moving average (ARIMA) models have been identified by Foster [1977], Griffin [1977], Watts [1975], and Brown and Rozeff [1979]. More recent work by Brown et al. [1987] provides support for the predictive ability of the Brown and Rozeff model.

TABLE 1

DESCRIPTION OF PRIMARY AND SUPPLEMENTARY TEST SAMPLES

Panel A: Determination of Primary Sample (PS):

Subpopulation of firms	374
Less	
a) Missing price data firms	(16)
b) Nonseasonal firms (SS1)	(126)
c) Volatile growth pattern firms and Inconsistent strata membership firms (SS2)	(123)
Primary Test Sample	109

Panel B: Sample Partitioning:

	Primary Sample	*Supplementary Sample 1*	*Supplementary Sample 2*
Upper	41	43	42
Middle	33	31	47
Lower	35	52	34
	109	126	123

the relative stability of the firm-size variable across time.

Due to the potential problem of classifying firms which exhibit volatile growth patterns across the data base as small or large, we deleted any firm which exhibited such unstable growth patterns. We do, however, provide profile information and examine the impact of firm-size on predictive ability for this group separately.

The empirical results support inter-firm differences in predictive ability of quarterly earnings data for the primary and supplementary sample firms which are partitioned by size.[3]

METHOD

We obtained a subpopulation of 374 calendar year-end New York Stock Exchange firms which had complete quarterly earnings data available for the 1967 to 1982 period on the Quarterly COMPUSTAT File. We used undeflated quarterly net income numbers before extraordinary items similar to the series analyzed by Foster [1977], Griffin [1977], and Lorek [1979].[4] Although firms in the subpopulation are subject to a survivorship bias, the relatively large number of firms analyzed in the primary and supplementary samples is of interest in its own right.

Panel A of Table 1 presents detailed

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[3] Lev [1983] provides a nonexhaustive listing of additional variables germane to the time-series properties of annual earnings data. These variables were drawn primarily from the industrial organization literature in economics. In addition to firm-size, they include: product type, competition, and capital intensity. They provide a convenient starting point for additional research on the inter-firm differences of quarterly earnings data.

[4] Time-series researchers have analyzed numerous deflated and undeflated quarterly earnings series with results that appear to be robust with respect to the general ARIMA structures of the parsimonious models. For example, see Brown and Rozeff [1979] and Brown et al. [1987] for studies which analyzed the quarterly earnings per share series.

information on how the subpopulation of 374 firms was used to derive the primary sample of 109 firms. First, 16 firms were eliminated because they had missing security price data needed to determine the firm-size proxy (to be described later). We also deleted 126 firms which exhibited nonseasonal behavior at the seasonal lags of their SACFs. A method similar to that used by Lorek and Bathke [1984] was applied wherein the SACF of the stationary, first-differenced ($d=1$, $D=0$) series for each firm was examined, and any firm that exhibited nonseasonal behavior at the seasonal lags of 4, 8, and 12 was deleted from the sample.[5] We refer to these firms as supplementary sample one (SS1).

We then eliminated 123 firms which had volatile growth patterns or inconsistent strata membership during the identification period (e.g., they were not consistently viewed as a "large" firm). This was accomplished by trichotomizing the remaining 232 firms, based on size, at three different points in time. Specifically, based on the market value of common stock the firms were ranked from largest to smallest at three points in time: the beginning (last day of the first quarter of 1967 (MV_{67}), middle (last day of the third quarter of 1973 (MV_{73}), and end (last day of the fourth quarter of 1979 (MV_{79}).[6] Each of these three groups of firms was then trichotomized into upper, middle, and lower firm-size strata. A firm was deleted if it exhibited inconsistent strata membership over time (e.g., lower, lower, middle). A firm was also deleted if it exhibited highly volatile firm-size growth patterns. We based growth pattern volatility on the relative change in size. Specifically, for each firm we computed two ratios: MV_{73}/MV_{67} and MV_{79}/MV_{73}. We then ranked each of these two sets of ratios from highest to lowest. A firm was viewed as exhibiting highly volatile growth and deleted if it were in the upper or lower decile for either of the two rankings.[7] Since these filters are not mutually exclusive (i.e., a firm could be eliminated due to both inconsistent membership and volatile growth), we treat these firms together (i.e., $n=123$) as supplementary sample two (SS2).[8]

Panel B of Table 1 provides detailed information on strata membership (upper, middle, and lower) for the primary sample. Partitioning of the sample yielded 41 firms in the upper, 33 firms in the middle, and 35 firms in the lower strata. Corresponding strata membership values for SS1 and SS2 are also provided in panel B of Table 1.[9]

The primary sample of 109 firms is larger than the samples of Foster [1977] and Griffin [1977], who analyzed 69 and 90 firms, respectively. Also, the additional controls which have been implemented regarding firm-size, nonseasonality, and growth pattern variability increase the internal validity of the present study.

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[5] Lorek and Bathke [1984, p. 371] report that nonseasonal firms have ranged from a low of 7.25 percent of the total sample in Foster [1977] to a high of 55.55 percent in Coates [1972]. In the present paper, 33.69 percent of the firms in the subpopulation were nonseasonal.

[6] Collins et al. [1987] and Freeman [1987] use a similar variable as a firm-size proxy.

[7] The ten percent criterion was determined subjectively after considering the tradeoff between establishing relatively homogeneous subgroups within our primary test sample and maintaining an adequate number of firms for testing purposes.

[8] Separate analysis of the SACF and PACF functions for the volatile and inconsistent growth firms did not reveal any substantial differences in the time-series properties of these firms.

[9] Since tests of the nonseasonal (SS1) and volatile and inconsistent growth (SS2) firms are supplementary in nature, we used the cut-off values derived from the market value statistics of the primary sample for partitioning. This procedure coupled with differential numbers of volatile firms being deleted from each strata resulted in varying numbers of firms in each strata.

PROFILE ANALYSIS OF PRIMARY AND SUPPLEMENTARY SAMPLES

Table 2 presents profile information on the test sample firms partitioned into upper, middle, and lower strata. We report median and range values on the market value of common stock, annual income, variance of income, and the coefficient of variation of income. We also report the mean number of loss quarters and the extent of industry representation within each strata.

The division of the test sample into upper, middle, and lower strata results in sizable firm-size differences across strata. For example, as Table 2 indicates, the median market value of common equity at December 31, 1979 for the upper strata firms was $1,281.2 million which is considerably greater than the corresponding median value for the lower strata firms of $62.6 million.[10]

There are sizable differences in the median levels of annual income and earnings volatility across strata. For example, median upper strata annual income is $82.4 million compared to $5.9 million for the lower strata firms. These differences in strata are even more pronounced for the earnings volatility numbers. Although a direct function of firm-size, the median annual income variances are $2,314.9, $117.1, and $7.1 million, respectively, for upper, middle, and lower strata firms. Imhoff [1978] has argued that the coefficient of variation is a better index of earnings volatility across samples of firms than the variance measures reported above since the variability is deflated by the respective means of annual income. The median coefficients of variation for the three strata portray similar levels of earnings volatility for the middle and lower strata firms (46.2 and 46.5, respectively) whereas the upper strata firms have a higher coefficient of variation (56.5). Thus, the reduced level of predictive ability for the small firms is not simply an artifact of earnings variability. That is, it was still more difficult to predict earnings for the lower strata firms despite the slightly greater earnings volatility exhibited by the upper strata firms.

The last two columns of Table 2 present the mean number of loss quarters across the identification period and the number of different 4-digit SIC codes represented within each strata. Despite the greater coefficient of variation of the upper strata firms, the lower strata firms reported a 4.7 times greater average number of loss quarters (1.86) than the upper strata firms (.39). This is consistent with the dramatically larger annual income reported for the upper strata firms *vis-a-vis* the lower strata firms. Finally, the SIC codes show that a broad spectrum of businesses is represented within each strata.

For comparability, we also report profile information on the nonseasonal SS1 and the volatile growth and inconsistent firm-size SS2 supplementary samples in Table 3. We partitioned the SS1 and SS2 samples using the upper, middle, and lower cutoff values for market value of equity determined on December 31, 1979 on the primary sample. There is a slightly greater percentage of lower strata firms (41 percent or 52/126) for the nonseasonal SS1 firms compared to the primary sample (32 percent or 35/109). Unlike the primary sample, the median coefficient of variation for the lower strata nonseasonals (70.0) is greater than the upper (64.6) and middle strata firms

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[10] It appears that the upper strata firms compare favorably in size to the largest size quintile reported by Collins et al. [1987] that had a median market value of equity of $1,277.6 million. Our lower strata firms approximate those in their second quintile which had a median market value of equity of $53.3 million.

TABLE 2
PROFILE OF PRIMARY SAMPLE OF FIRMS
($n = 109$)

	Market Value of Common Stock at 12/31/79 (in \$ Millions)		*Annual Income for 1967–1979 Period (in \$ Millions)*				*Coefficient of Variation*		*Number of Loss Quarters*		*Industry Representation (4-Digit SIC Codes)*	
			Average		*Variance*							
Strata Size	*Median*	*Range*	*Median*	*Range*	*Median*	*Range*	*Median*	*Range*	*Mean*	*Range*	*Total Number of Industries Represented*	*Highest Industry Concentration*
Upper (n=41)	1281.2	608.5 to 37516.5	82.4	41.2 to 2078.4	2314.9	384.5 to 806138.5	56.5	27.1 to 93.6	0.39	0 to 4	26	#2830 Drugs – 5 #2911 Petroleum Refining —4
Middle (n=33)	307.0	156.2 to 564.5	23.6	14.1 to 45.2	117.1	17.4 to 1182.4	46.2	20.3 to 122.9	0.64	0 to 6	21	#4931 Electric & Other Services Combined—8 #4911 Electric Services—5
Lower (n=35)	62.6	5.5 to 150.5	5.9	1.6 to 13.4	7.1	0.5 to 83.7	46.5	14.3 to 96.1	1.86	0 to 11	29	#4911 Electric Services—3 #2250 Knitting Mills—3

TABLE 3
PROFILE OF SUPPLEMENTARY SAMPLES

	Market Value of Common Stock at 12/31/79 (in $ Millions)	Annual Income for 1967–1979 Period (in $ Millions)				Industry Representation (4-Digit SIC Codes)		
Strata Size	*Median*	*Average Median*	*Variance Median*	*Coefficient of Variation Median*	*Number of Loss Quarters Mean*	*Total Number of Industries Represented*		*Highest Industry Concentration*
Panel A: Profile of Nonseasonal Firms [SS1] (n=126):								
Upper ($n=43$)	1608.2	92.3	3461.7	64.6	0.70	24	#2911 #2800	Petroleum Refining—8 Chemicals & Allied Products—5
Middle ($n=31$)	285.5	22.1	154.3	61.5	1.00	25	#3310 #6025	Blast Furnaces & Steel Works—3 National Banks—3
Lower ($n=52$)	59.1	4.9	18.3	70.0	5.88	36	#6022 #3310 #3662	State Banks—5 Blast Furnaces & Steel Works—4 Radio-TV Transmissions—4
Panel B: Profile of Volatile Growth and Inconsistent Strata Membership Firms [SS2] (n=123):								
Upper ($n=42$)	1042.1	60.5	1104.0	61.0	0.40	33	#3533 #2844	Oil Field Machinery & Equipment—3 Perfume & Cosmetics—3
Middle ($n=47$)	248.9	17.7	110.2	52.4	1.26	35	#4911 #4931	Electric Services—6 Electric & Other Services Combined—4
Lower ($n=34$)	73.2	7.2	11.1	52.5	4.12	28	#4931	Electric & Other Services Combined—3

(61.5). There is also a sizable increase in the mean number of loss quarters for the lower strata firms of both the nonseasonal (5.88) and the volatile and inconsistent growth firms (4.12). The firms in both supplementary samples exhibit greater coefficients of variation across strata than the primary sample firms.

DESCRIPTIVE ANALYSIS OF SAMPLE FIRMS

Panel A of Table 4 presents the average cross-sectional SACF and partial autocorrelation function (PACF) across lags 1 through 12 for the 109-firm test sample computed for the quarterly earnings data over the 1967–1979 identification period.[11] Panel A presents these values for the raw data or levels of quarterly net income ($d=0$, $D=0$) for the entire sample as well as the upper, middle, and lower strata firms, separately.[12] Subject to the potential nonstationarity of the raw data, an apparent size-effect is evidenced by the SACF values of the upper strata firms. The SACF values of the upper strata firms are consistently greater than those of the lower strata firms at all lags except the eighth and twelfth. These results may simply be a function of the growth variability screen which deleted volatile growth pattern firms. Alternatively, they may be due to sampling variation induced by the potential nonstationarity of the levels of the quarterly income series.[13] Nevertheless, these results are also consistent with a size-effect.

The SACF and PACF values of the consecutively differenced data ($d=1$, $D=0$) as well as the consecutively *and* seasonally differenced data ($d=1$, $D=1$) did not exhibit any systematic differences across strata and are, therefore, not reported. However, panel B contains the SACF and PACF of the seasonally differenced series ($d=0$, $D=1$). The SACF values for the first three lags of the upper strata firms are consistently greater than these reported for the middle and lower strata firms.

The descriptive results for the primary sample can be summarized in the following manner.[14] First, autocorrelation levels of the undifferenced quarterly income series reveal a size-effect wherein larger firms exhibit higher levels of autocorrelation than smaller firms. However, the impact of this finding must be tempered by the potential nonstationary behavior exhibited by the levels of quarterly income. Second, the differential results across firm-size strata in panel A of Table 4, coupled with the higher levels of autocorrelation for larger firms reported in panel B provide some support for the existence of systematic differences in the time-series properties of quarterly earnings. Of course, the lack of differences in the SACF functions for the consecutively differenced ($d=1$, $D=0$) and consecutively and seasonally differenced ($d=1$, $D=1$) data mitigates the possible impact of this result. Third, controls implemented to remove nonseasonal firms were successful in isolating firms which exhibit different time-series behavior relative to highly seasonal firms.

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[11] The last 12 quarters of data, 1980–1982, were withheld for prediction testing. Also, the estimated standard error for the SACF and PACF for lags up to 12 is approximately .14 for each combination of differencing.

[12] We also conducted an analysis of the SACF and PACF functions for the 374-firm subpopulation and found the values to be quite similar to other time-series results reported by Foster [1977] and Griffin [1977]. Considerable support was found for the three parsimonious ARIMA models discussed earlier in the paper.

[13] See McLeary and Hay [1980] for a discussion of why a slowly dampening SACF is indicative of a nonstationary process.

[14] We also computed cross-sectional SACFs and PACFs for the nonseasonal SS1 ($n=126$) and the volatile growth and inconsistent firm-size SS2 ($n=123$) subsamples. Raw data of the SS1 firms exhibited autoregressive tendencies with no spikes at the seasonal lags of 4, 8, or 12. The patterns of these functions for the SS2 firms were very similar to those evidenced by the primary test sample.

TABLE 4

CROSS-SECTIONAL SAMPLE AUTOCORRELATIONS AND PARTIAL AUTOCORRELATIONS: 1967–1979
(MEANS AND STANDARD DEVIATIONS)

Panel A: Levels of Net Income ($d=0$, $D=0$):

	Lags											
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
Test Sample ($n=109$)												
ACF	.572 (.280)	.487 (.356)	.422 (.272)	.602 (.167)	.318 (.268)	.271 (.305)	.233 (.232)	.392 (.167)	.180 (.197)	.145 (.228)	.129 (.161)	.253 (.126)
PACF	.572 (.280)	.158 (.299)	.074 (.236)	.296 (.195)	−.234 (.143)	−.018 (.123)	.007 (.117)	.058 (.117)	−.075 (.103)	−.019 (.099)	.019 (.108)	−.011 (.102)
Upper Strata ($n=41$)												
ACF	.730 (.175)	.659 (.225)	.555 (.206)	.615 (.179)	.431 (.229)	.393 (.246)	.324 (.214)	.295 (.176)	.255 (.178)	.229 (.191)	.182 (.155)	.238 (.120)
PACF	.730 (.175)	.197 (.261)	.011 (.233)	.219 (.182)	−.237 (.141)	.002 (.080)	.015 (.117)	.063 (.096)	−.119 (.083)	−.004 (.089)	.014 (.098)	−.009 (.092)
Middle Strata ($n=33$)												
ACF	.579 (.245)	.516 (.311)	.452 (.229)	.647 (.121)	.371 (.216)	.329 (.243)	.275 (.174)	.433 (.109)	.226 (.153)	.190 (.176)	.168 (.116)	.281 (.093)
PACF	.579 (.245)	.215 (.298)	.106 (.251)	.335 (.184)	−.218 (.139)	−.022 (.147)	.002 (.104)	.051 (.094)	−.064 (.085)	−.014 (.106)	.051 (.120)	−.018 (.107)
Lower Strata ($n=35$)												
ACF	.381 (.297)	.259 (.403)	.237 (.279)	.545 (.176)	.137 (.265)	.074 (.328)	.087 (.233)	.351 (.196)	.049 (.195)	.004 (.250)	.030 (.162)	.242 (.155)
PACF	.381 (.297)	.057 (.325)	.118 (.215)	.349 (.195)	−.244 (.151)	−.038 (.138)	.003 (.131)	.060 (.155)	−.033 (.121)	−.040 (.105)	−.004 (.103)	−.006 (.110)

TABLE 4—*Continued*

Panel B: Seasonal Differences of Net Income ($d=0, D=1$):

	Lags											
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
Test Sample ($n=109$)												
ACF	.442 (.222)	.232 (.216)	.084 (.212)	−.135 (.260)	−.033 (.215)	−.003 (.208)	−.015 (.191)	−.014 (.187)	−.017 (.149)	−.007 (.149)	−.003 (.133)	−.006 (.134)
PACF	.442 (.222)	−.025 (.180)	−.060 (.166)	−.216 (.178)	.104 (.147)	.008 (.150)	−.044 (.144)	−.104 (.150)	.011 (.130)	−.010 (.119)	−.022 (.120)	−.084 (.114)
Upper Strata ($n=41$)												
ACF	.551 (.194)	.348 (.206)	.172 (.233)	−.007 (.289)	.049 (.232)	.045 (.216)	.017 (.194)	.006 (.190)	−.017 (.177)	−.001 (.147)	−.005 (.123)	−.001 (.145)
PACF	.551 (.194)	−.005 (.199)	−.066 (.168)	−.146 (.193)	.124 (.160)	.018 (.146)	−.053 (.130)	−.099 (.141)	.006 (.131)	.004 (.105)	−.039 (.112)	−.068 (.126)
Middle Strata ($n=33$)												
ACF	.384 (.195)	.155 (.220)	.028 (.213)	−.201 (.232)	−.039 (.179)	.036 (.170)	−.001 (.179)	−.002 (.195)	−.009 (.111)	.005 (.152)	.009 (.151)	.007 (.146)
PACF	.384 (.195)	−.040 (.183)	−.056 (.155)	−.260 (.139)	.127 (.128)	.017 (.160)	−.078 (.149)	−.095 (.152)	.027 (.141)	.013 (.116)	−.002 (.124)	−.064 (.117)
Lower Strata ($n=35$)												
ACF	.368 (.229)	.170 (.164)	.034 (.147)	−.221 (.185)	−.123 (.190)	−.097 (.204)	−.065 (.195)	−.048 (.175)	−.024 (.148)	−.026 (.149)	−.013 (.129)	−.023 (.107)
PACF	.368 (.229)	−.034 (.157)	−.056 (.177)	−.255 (.169)	.059 (.141)	−.013 (.147)	−.001 (.147)	−.118 (.160)	.003 (.119)	−.049 (.131)	−.023 (.126)	−.121 (.087)

Note: d=Consecutive differencing
D=Seasonal differencing
ACF=Autocorrelation function
PACF=Partial autocorrelation function

TABLE 5

PRIMARY SAMPLE Q-STATISTICS AND MEDIAN TESTS FOR IDENTIFICATION PERIOD (1967–1979)

			Deciles								
Model	*Mean Q-statistic*	*Standard Deviation*	*.1*	*.2*	*.3*	*.4*	*.5*	*.6*	*.7*	*.8*	*.9*
Panel A: Descriptive Goodness of Fit: Time-Series Models:											
Upper Strata											
F[1]	17.61	9.05	5.72	8.95	11.63	14.33	16.53	17.31	21.56	23.38	27.49
BR	13.92	9.28	4.23	5.65	7.29	9.17	11.85	13.07	14.96	18.35	23.87
GW	11.45	6.04	3.86	6.04	7.26	9.10	10.55	11.03	14.23	15.05	18.96
Middle Strata											
F	18.41	10.29	9.87	10.61	13.14	13.69	15.69	17.30	20.18	23.01	28.60
BR	13.43	5.98	6.59	8.10	10.13	10.84	12.24	13.60	15.39	17.10	19.91
GW	13.22	8.60	4.26	6.81	8.42	9.26	11.38	13.09	13.53	16.35	23.22
Lower Strata											
F	15.42	6.51	7.59	10.44	11.11	13.75	14.95	15.27	16.17	17.00	23.59
BR	11.42	4.89	5.46	7.03	7.75	9.62	10.46	11.37	12.50	14.97	17.81
GW	11.45	4.63	5.44	7.25	8.07	9.15	10.73	11.94	12.96	15.34	16.73

Panel B: K*-sample Median Test:*

	F	*BR*	*GW*
Chi-square[2]	3.531	3.016	.074
p-value	.171	.221	.964

[1] F=Foster's (100)×(010) with drift model
BR=Brown and Rozeff's (100)×(011) model
GW=Griffin and Watts' (011)×(011) model

[2] The degrees of freedom are two (three strata minus one).

MODELING CONSIDERATIONS

In this section we present descriptive statistics on the time-series models for the upper, middle, and lower strata firms. Inspection of the patterns exhibited by the SACFs and PACFs in Table 4 provides support for the three premier models attributed to Foster [1977], Brown and Rozeff [1979], Griffin [1977], and Watts [1975] for each strata. For example, patterns in the SACFs and PACFs of the seasonally differenced series in panel B are supportive of both the Foster (100)×(010) and Brown and Rozeff (100)×(011) structures for each strata. Although we did not report the consecutively and seasonally differenced SACF and PACF values in Table 4, all three strata exhibited spikes in the SACFs at lags one and four coupled with a gradual dampening of the PACF values. These characteristics strongly support the (011)×(011) structure of the Griffin and Watts model. Therefore, we estimate each of the three premier models for our primary sample.

Panel A of Table 5 presents the mean, standard deviation, and decile distributions for the Box-Pierce Q-statistics for each of the premier models.[15] In general, the Foster model consistently exhibits the largest average Box-Pierce Q-statistic across strata. In fact, in excess of 30 percent of the upper and middle strata firms had Q-statistics exceeding the conventional Type I error ($\chi^2_{11,\alpha=.05}=19.675$) for the Foster model. However, much better fit is evidenced for the lower strata firms with only ten percent exceeding the critical value. Both the Brown and Rozeff and Griffin and Watts models have lower average Q-statistics and narrower decile distributions than those of the Foster model. With the conventional Type I error for these models ($\chi^2_{10,\alpha=.05}=18.31$), virtually all sample firms in the lower strata have residuals which behave as a white noise series.

Panel B presents tests for the equivalence of the Q-distributions across the three strata using the K-sample median test [Hollander and Wolfe, 1973, pp. 114-119]. The chi-square statistics for each model are insignificant at conventional levels indicating that goodness of fit is not significantly different across the three size groups. Therefore, firm-size does not affect the appropriateness of the choice of a common model structure among the premier models tested.[16]

Panel A of Table 6 presents average parameter values estimated for each model across the identification period. An interesting result is the monotonic decline in the average values of the autoregressive parameter when moving from larger to smaller firms (.588, .405, .389) for the Foster model. This result also holds for the autoregressive parameter in the Brown and Rozeff model (.768, .585, .490). To determine whether firm-size explains differences in parameter values, we conducted a K-sample median test on the parameters of the Foster, Brown and Rozeff, and Griffin and Watts models (panel B of Table 6). The chi-square statistics were significant for the AR(1) parameters of both the Foster and Brown and Rozeff models with p-values of .028 and .001, respectively. However, the MA(4) parameter in the Brown and Rozeff model as well as the MA(1) and MA(4) parameters in the Griffin and Watts model were insignificant. We then used the Mann-Whitney U-test to determine which strata comparisons for the autoregressive parameters in the Foster and Brown and Rozeff models contributed to the overall significance levels reported above. Panel C of Table 6 indicates that the AR(1) parameters for the upper strata firms in both the Foster and Brown and Rozeff models were significantly different than those of both the middle and lower strata firms with p-values of .001, respectively. However, comparisons between the middle and lower strata firms were insignificant.[17]

PREDICTIVE FINDINGS

We assessed the predictive ability of four different models on the sample: Foster's (100)×(010) with drift model, Griffin and Watts' (011)×(011) model, and Brown and Rozeff's (100)×(011) model as well as the seasonal random walk with drift model (SRW) for com-

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[15] The Box-Pierce Q-statistic is distributed approximately as a chi-square with $K-n$ degrees of freedom where K is the number of lags in the SACF and n is the number of regular and seasonal parameters. Briefly, it tests whether the entire residual SACF is different from that expected of a random series.

[16] We also conducted a K-sample median test on the Q-statistics of the SS1 and SS2 samples with similarly insignificant differences across firm-size strata.

[17] We identified a (100)×(000) simple autoregressive process for the nonseasonal SS1 firms similar to Lorek and Bathke [1984]. We also ran the three premier models on both the SS1 firms and SS2 firms since the SS2 firms exhibited similar SACF and PACF behavior to the primary sample. Statistical testing of the parameter values provided results similar to those of the primary sample with significant differences in the autoregressive parameters and insignificant differences in the moving average parameters.

TABLE 6
PRIMARY SAMPLE DESCRIPTIVE STATISTICS ON TIME-SERIES PARAMETERS FOR IDENTIFICATION PERIOD (1967–1979)

Panel A: Average Parameter Values: Time-Series Models:

Foster's (100)×(010) with Drift Model

Strata	*Mean AR(1) Parameter*	*Standard Deviation*	*Range*		*Mean Drift Term*
			Minimum	*Maximum*	
Upper	.588	.215	.188	.986	2.605
Middle	.405	.209	.077	.943	.402
Lower	.389	.242	−.093	.747	.103

Brown and Rozeff's (100)×(011) Model

Strata	*Parameter*	*Mean*	*Standard Deviation*	*Minimum*	*Maximum*
Upper	AR(1)[1]	.768	.176	.385	.999
	MA(4)	.305	.407	−.865	.849
Middle	AR(1)	.585	.230	.194	.988
	MA(4)	.380	.233	−.448	.749
Lower	AR(1)	.490	.224	.052	.909
	MA(4)	.431	.319	−.325	.942

Griffin and Watts' (011)×(011) Model

Strata	*Parameter*	*Mean*	*Standard Deviation*	*Minimum*	*Maximum*
Upper	MA(1)	.354	.283	−.352	.799
	MA(4)	.460	.386	−.649	.892
Middle	MA(1)	.500	.264	−.284	.908
	MA(4)	.544	.261	−.224	.934
Lower	MA(1)	.465	.276	−.010	.956
	MA(4)	.513	.297	−.251	.911

Panel B: K-sample Median Test on Parameter Values:

	Foster	*Brown and Rozeff*		*Griffin and Watts*	
	AR(1)	*AR(1)*	*MA(4)*	*MA(1)*	*MA(4)*
Chi-square[2]	7.185	19.763	3.87	.902	.074
p-value	.028	.001	.144	.637	.964

parative purposes. We included all three premier models due to the descriptive evidence reported earlier. The SRW model is likely to be superior to the simple random walk model in the present setting given the highly seasonal nature of the sample firms and the SRW's relatively strong performance in Foster [1977].

One-step-ahead quarterly earnings pre-

TABLE 6—*Continued*

Panel C: Mann-Whitney U-tests on AR(1) Parameters:

	Foster	Brown and Rozeff
Paired Comparison	*AR(1)* p-*value*	*AR(1)* p-*value*
Upper-Middle	.001	.001
Upper-Lower	.001	.001
Middle-Lower	.975	.153

[1] AR(1)=First order autoregressive parameter.
MA(1)=First order moving-average parameter.
MA(4)=Fourth order (seasonal) moving-average parameter.

[2] The degrees of freedom are two.

dictions were generated in an *ex ante* sense for all forecast models. The original estimation period for each model began in the first quarter, 1967, and ended with the fourth quarter, 1979. The 12 quarters within the 1980–1982 interval were used as the holdout period. The parameters of the time-series models were estimated over the 1967–1979 period in order to generate the first quarter, 1980 predictions. The parameters were then reestimated prior to making each additional one-step-ahead prediction over the 1980–1982 period. We rolled forward the data bases by sequentially appending the most recent actual quarterly earnings number until the fourth quarter, 1982 forecasts were generated. In summary, the forecast profile is based on one-step-ahead quarterly earnings forecasts originating in each of 12 quarters for 109 test sample firms yielding 1,308 origin date forecasts for each model.

Similar to Bathke and Lorek [1984], we calculated two error metrics: mean absolute percentage error (*MAPE*) and mean squared error (*MSE*):

$$MAPE=\frac{1}{n}\sum\left|\frac{A-F}{A}\right|$$

$$MSE=\frac{1}{n}\sum\left(\frac{A-F}{A}\right)^2,$$

where

n = number of sample firms,
A = actual quarterly earnings, and
F = forecasted quarterly earnings.

MAPE gives equal weighting to all forecast errors which is consistent with a linear loss function. The *MSE* metric gives greatest weight to large forecast errors consistent with a quadratic loss function. Since the results of the multivariate statistical test used were not sensitive to the choice of error metric, *MAPE* is used for exposition purposes. Additionally, we computed the mean forecast error (*MFE*) as a measure of bias. $MFE=1/n\Sigma(A-F)/A$. With *MFE*, forecast errors of differing signs are allowed to cancel to provide information on the directionality of the forecast errors. Table 7 presents summary statistics on the *MAPE* error metrics.[18] The results are partitioned by strata of sam-

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[18] All forecast errors greater than 100 percent were truncated to 100 percent prior to statistical testing. We also ran statistical tests based on a 300 percent truncation scheme with similar results. See Table 8 for details on the number of truncations across models and strata.

TABLE 7
MEAN ABSOLUTE PERCENTAGE ERRORS OF ONE-STEP-AHEAD PREDICTIONS FOR PRIMARY SAMPLE
(1980–1982)

	Quarter				*Year*				
Model	*First*	*Second*	*Third*	*Fourth*	*1980*	*1981*	*1982*	*Pooled*	*MFE*
				Upper Strata ($n=41$)					
F[1]	.292	.277	.345	.289	.263	.304	.335	.301	−.017
BR	.260	.256	.312	.274	.230	.269	.327	.276	.014
GW	.276	.247	.340	.282	.256	.284	.318	.286	−.028
SRW	.319	.301	.378	.326	.289	.308	.396	.331	−.033
				Middle Strata ($n=33$)					
F	.264	.281	.293	.388	.276	.285	.360	.307	−.033
BR	.291	.255	.249	.402	.265	.298	.335	.299	−.012
GW	.281	.255	.237	.410	.273	.281	.334	.296	−.065
SRW	.281	.329	.378	.397	.315	.305	.419	.346	−.025
				Lower Strata ($n=35$)					
F	.470	.456	.393	.447	.441	.408	.476	.442	.027
BR	.423	.432	.378	.432	.442	.374	.434	.416	.073
GW	.423	.430	.391	.411	.441	.379	.421	.414	−.004
SRW	.456	.460	.427	.474	.446	.426	.491	.454	.041

[1] F=Foster's Model: (100)×(010) with drift
BR=Brown and Rozeff Model: (100)×(011)
GW=Griffin and Watts Model: (011)×(011)
SRW=Seasonal random walk model with drift
MFE=Mean forecast error or bias

ple firms (upper, middle, and lower); forecast model (Foster, Brown and Rozeff, Griffin and Watts, and SRW); quarter of the one-step-ahead forecast (first–fourth); year (1980–1982); as well as across all quarters and years on an aggregate (pooled) basis. In general, the *MAPE* results are better for the upper and middle strata firms versus the lower strata firms. The significance of these differences is tested below. We also observe that *MFE* is negative for seven of the eight forecast models in the upper and middle strata. However, three of the four forecast models have positive *MFE* metrics for the lower strata firms. Table 8 provides detailed information on the number of truncations or outliers for each strata and forecast model. The percentage of forecast errors affected by the 100 percent truncation scheme was 12.2 percent and 10.2 percent for the upper and middle strata firms, respectively, while the lower strata firms had a much greater percentage of 20.0 percent. The tenor of these results was similar when the truncation scheme was 300 percent with 3.6 percent for upper, 4.4 percent for middle, and 6.2 percent truncations for the lower strata firms.

Our primary hypotheses are tested by using a multivariate analysis of variance

TABLE 8

TRUNCATION OF *MAPE* METRICS FOR PRIMARY SAMPLE PREDICTIONS (1980-1982)

	100 Percent[1]		*300 Percent*			
	Number of Truncations	*Percentage*	*Number of Truncations*	*Percentage*	*Total Number of Forecasts*	
			Upper Strata ($n=41$)			
F[2]	65	13.2	18	3.7	492	(41×12)
BR	45	9.2	11	2.2	492	
GW	53	10.8	13	2.6	492	
SRW	78	15.9	29	5.9	492	
Total	241	12.2	71	3.6	1,968	
			Middle Strata ($n=33$)			
F	39	9.8	16	4.0	396	(33×12)
BR	37	9.3	17	4.3	396	
GW	37	9.3	16	4.0	396	
SRW	48	12.1	20	5.1	396	
Total	161	10.2	69	4.4	1,584	
			Lower Strata ($n=35$)			
F	91	21.7	27	6.4	420	(35×12)
BR	77	18.3	23	5.5	420	
GW	78	18.6	25	6.0	420	
SRW	90	21.4	29	6.9	420	
Total	336	20.0	104	6.2	1,680	

[1] 100 percent = All forecast errors greater than 100 percent were truncated to 100 percent.
300 percent = All forecast errors greater than 300 percent were truncated to 300 percent.

[2] See definitions in Table 7.

design slightly more complex than that used by Collins and Hopwood [1980]. The null hypothesis is:

> H_0: There is no difference in the forecast errors generated by each of the four time-series models on the test sample of firms across firm-size strata.

We use a multivariate, repeated measure design since each sample firm was measured 12 times (4 quarters × 3 years) for each forecast model with a crossed design on the forecast model, quarter, and year factors. Similar to Collins and Hopwood [1980], our repeated measure design avoids making an assumption of equality of subgroup covariance matrices which is not necessary since our tests are based on one sample of firms. Our relatively large sample of forecast errors, which is comprised of 1,308 forecast origin dates for each model, mitigates possible violation of the multivariate normality assumption.[19]

The *F*-ratio of 4.60 with degrees of freedom of two and 106 is significant at the .012 level for the test sample firms.[20] This enables rejection of the primary null hypothesis of no difference in forecast errors across firm-size strata. We then performed the Tukey *post hoc* procedure to determine which strata comparisons were significantly different.[21] The results indicate that the grand means of the *MAPE*s for the upper (.299) and middle strata firms (.312) are significantly smaller than those of the lower strata firms (.432) at the .05 level. Although the difference between the upper and middle strata firms is statistically insignificant, the upper strata firms did report consistently smaller forecast errors.[22]

Three additional hypotheses were also tested under the framework of the repeated measure MANOVA design. First, we tested the null hypothesis that there was no difference in the forecast errors generated by each of the four forecast models *across* the years, quarters, and size factors. An *F*-ratio of 13.63 obtained with a significance level of .001 (df=3 and 104). However, univariate matched paired comparisons using Tukey's *post hoc* procedures revealed insignificant comparisons between the grand means of the *MAPE*s for the Foster (.348), Brown and Rozeff (.328), Griffin and Watts (.330), and SRW (.375) models. Note that it is possible to reject in the multivariate test without rejecting any corresponding univariate matched pair comparisons due to the ability of the multivariate test to consider the effect of all variables jointly [Stevens, 1986, pp. 128–129]. However, the relatively lower forecast errors of the Brown and Rozeff and Griffin and Watts models versus both the Foster and SRW models were not unexpected given the superiority of these models in extant time-series work (see Brown et al. [1987] for similar findings).

The second additional hypothesis which we tested concerned the year-effect. Specifically, we tested the null hypothesis that there was no difference in the forecast errors generated in each of the three years (1980–1982) *across* models, quarters, and size factors. An *F*-ratio of 4.47 obtained with a significance level of .014 (df=2 and 105). Similar to the *post hoc* tests on the model-effect, there were no significant pairwise comparisons between the grand means of the *MAPE*s in 1980 (.325), 1981 (.325), and 1982 (.385). Also, the higher forecast errors in 1982 were attributable to all forecast models and not limited to a subset of the models.

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[19] The multivariate test statistic for our repeated measures design is based on $(K-1)$ transformed size variables. Since the original number of levels of the size variable was three (upper, middle, and lower), testing was on two orthonormal transformed variables to assure greater conformity with the normality assumption. See Stevens [1986, pp. 416–419] for a discussion of the transformation process used in MANOVA.

[20] The degrees of freedom were $(K-1)=2$ or $(3-1)$ for the numerator and $(n-(K-1)-1)$ or $(109-(2)-1)=106$ for the denominator. The n = sample size, whereas $(K-1)$ refers to the number of orthonormalized size variables. We obtained virtually identical results in the MANOVA test after suppressing the SRW model. Therefore, the results are not driven by a singular, misspecified naive model.

[21] The results are insensitive to several alternative *post hoc* procedures including the Student Newman-Keuls multiple range test and the Scheffe method. Stevens [1986, pp. 419–420] recommends use of the Tukey procedure in a repeated measure ANOVA setting.

[22] We also used the nonparametric, univariate Mann-Whitney *U*-test on the size-effect with virtually identical results to those reported for the MANOVA repeated measure design. Also, we retested the primary null hypothesis on the supplementary samples (SS1 and SS2). The overall tenor of these results was consistent with that of the primary sample. The consistently smaller forecast errors of the upper strata firms versus the lower strata firms for the test sample and both supplementary samples underscore the pervasive effect of firm-size on predictive ability.

The final hypothesis tested concerned the quarter-effect. The time-series literature has consistently documented a fourth quarter effect wherein forecast errors for the fourth fiscal quarter have been systematically greater than other quarters. Collins et al. [1984] attribute larger fourth quarter errors to a "settling up" or "dumping" effect by which accruals and deferrals on an interim basis are brought into correspondence with the annual numbers. We tested the null hypothesis that there was no difference in the forecast errors in each quarter *across* models, years, and size factors. The *F*-ratio of 1.46 (df=3 and 104) was not significant at conventional levels ($p=.23$). However, the firm-size and quarter interaction was significant with an *F*-ratio of 2.87 (df=6 and 208) and a significance level of .01. This implies that the significance of the quarter of the forecast was highly dependent on the firm-size strata. Only the middle strata firms exhibited behavior consistent with this "dumping" effect with the following grand means of the *MAPE*s across models for the first (.279), second (.280), third (.289), and fourth (.399) quarters. The fourth quarter was not the most difficult quarter to predict for the other strata firms.

LIMITATIONS, EXTENSIONS, AND CONCLUDING REMARKS

Prior to discussing our conclusions, we briefly list the limitations associated with our particular research design. First, our primary and supplementary samples of firms are subject to the familiar survivorship bias associated with all time-series work due to the extensive earnings history required for model identification. Second, our analysis is limited to calendar year-end NYSE firms. Therefore, results may not pertain to firms listed on other exchanges (known to be subject to less coverage by financial analysts) or to non-calendar year-end firms. Third, despite the fact that we identified best fitting univariate time-series models for each strata of firms, multivariate time-series modeling techniques or econometric modeling procedures could produce different results.

Subject to the above caveats, we offer the following major conclusions:

1. Firm-size does not affect the appropriateness of the choice of common model structure of the time-series models identified for each strata of the test and supplementary samples.
2. Firm-size explains differences in the autoregressive parameters of the Foster [1977] and Brown and Rozeff [1979] ARIMA models wherein the values of these parameters are systematically larger for the upper strata (large) versus the middle and lower strata (small) firms in our test sample. Similar results are obtained for both supplementary samples. However, we found no significant differences in both moving average parameters in the Griffin [1977] and Watts [1975] models and the seasonal moving average parameter in the Brown and Rozeff [1979] model.
3. Our evidence is consistent with a pervasive firm-size effect on predictive ability. The significantly greater predictive power of larger firms was documented on our primary sample, the nonseasonal (SS1), and the volatile growth and inconsistent (SS2) firms.

Since the firm-size effect has been demonstrated to be a significant explanatory variable in capital market and distress prediction studies, our results may be useful in helping to further explain small and large firm price response in the capital markets area. Although it may not be necessary for researchers to conduct a separate analysis of small and large firms, it appears that some controls for the size effect may be appropriate. For example, size may simply be used as a deflator in the earnings change/price change relation.

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The Choice Among Accounting Alternatives and Management Compensation: Effects of Corporate Tax

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ABSTRACT: Does tax policy affect accounting choices? In this paper we examine how corporate tax affects management's accounting choices. Because (1) management compensation is typically linked to both accounting earnings and stock prices, (2) stock prices are related to cash flow distributions expected to be generated by the firm, (3) corporate-issued reports change cash flow assessments and, thus, affect compensation in a given period, and (4) changes in corporate tax rate changes the firm's cash flows, management will exploit its ability to "manage" reported accounting earnings in reaction to changes in tax rates, so as to maximize compensation. Assuming exogeneously determined generally accepted accounting principles, it is shown—using a stylized model—that increases in corporate tax rate induce choice of income-increasing accounting treatments. Empirical results applying logit analysis to a sample of compensation data are consistent with this implication of the model.

TAX policies have numerous objectives, including (1) raising revenue, (2) encouraging economic growth, (3) stabilizing the economy, (4) redistributing wealth, (5) encouraging activities recognized as priorities, and (6) prohibiting or otherwise deterring undesired actions. Often, it seems, only immediate, first order impacts of policy are the subject of deliberations. This paper addresses the subtler effects on information choices made by managers of corporations.

We focus on how tax affects management's accounting choices. Determination of generally accepted accounting principles (GAAP) is assumed exogenous; it is recognized that GAAP accord the manager some discretion in accounting choice. It is shown that increases in corporate tax rates induce choice of income-increasing accounting treatments. This implication of the stylized model developed is then tested empirically. The results confirm the model's

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implication: increases in the effective average corporate tax rate are associated with increased choice of income-increasing accounting treatments.

Section I describes the general scenario for the model, Section II models the impact of corporate tax and other parameters on accounting choice, and presents short-run and long-run analyses of the sensitivity of accounting choices to tax and other parameters. A test for the impact of tax on accounting choices is described in Section III and concluding remarks follow in Section IV.

I. THE EFFECT OF TAX ON ACCOUNTING CHOICE—GENERAL SCENARIO

Responses to questionnaires mailed as part of this study indicate that management compensation is linked to both accounting earnings and stock prices through incentive plans (see, also, Conference Board [1974], Healy [1985], and Murphy [1985]). Since stock prices are related to cash flow distributions expected to be generated by the firm, corporate-issued reports that change cash flow assessments will affect compensation in a given period. Hence, management would exploit its ability to "manage" reported accounting earnings, perceived as signalling its private information, to maximize compensation.

The compensation scheme, however, is only one of the major factors affecting accounting choices. The penalties associated with inaccurate signalling is another. Legal liability to owners and others for the issuance of misleading information and reputation effects give rise to such penalties [Kraakman, 1986]. Giving explicit recognition to these factors, effects of corporate tax changes on the optimal accounting choice can be analyzed. Figure 1 illustrates this framework by a feedback cycle that encompasses the users of financial statements (e.g., equity holders, creditors, and government) and preparers of accounting statements (management). The linkage is provided by the compensation scheme and the behavior of users utilizing accounting signals (Ronen and Sadan [1981] elaborate on this linkage).

The stylized modeling of the tax impact on financial accounting, described below, features a manager who maximizes the present value of his or her compensation, and owners who maximize the present value of their wealth over a two-period horizon. The linear compensation specification (treated here as exogenous) includes a restricted stock option in addition to a bonus (percentage of accounting earnings) as indicated in the responses to questionnaires.

A penalty for inaccuracy depicting reputation effects and legal liability is introduced. While exogenously specified in the limited setting we consider here, such penalty is more correctly viewed as endogenous in the global system—emerging to minimize adverse selection costs arising from information asymmetry between managers and investors [Ronen, 1979].

The purpose of the stylized model presented in the next section is to illustrate a way in which the effects of corporate tax changes on accounting choice can be signed so as to motivate hypothesis testing. This derived sign can be shown to be robust to extensive relaxations of the seemingly restrictive assumptions made, as explained below.[1]

II. A STYLIZED MODEL

Specification

Consider risk neutral owners of a firm

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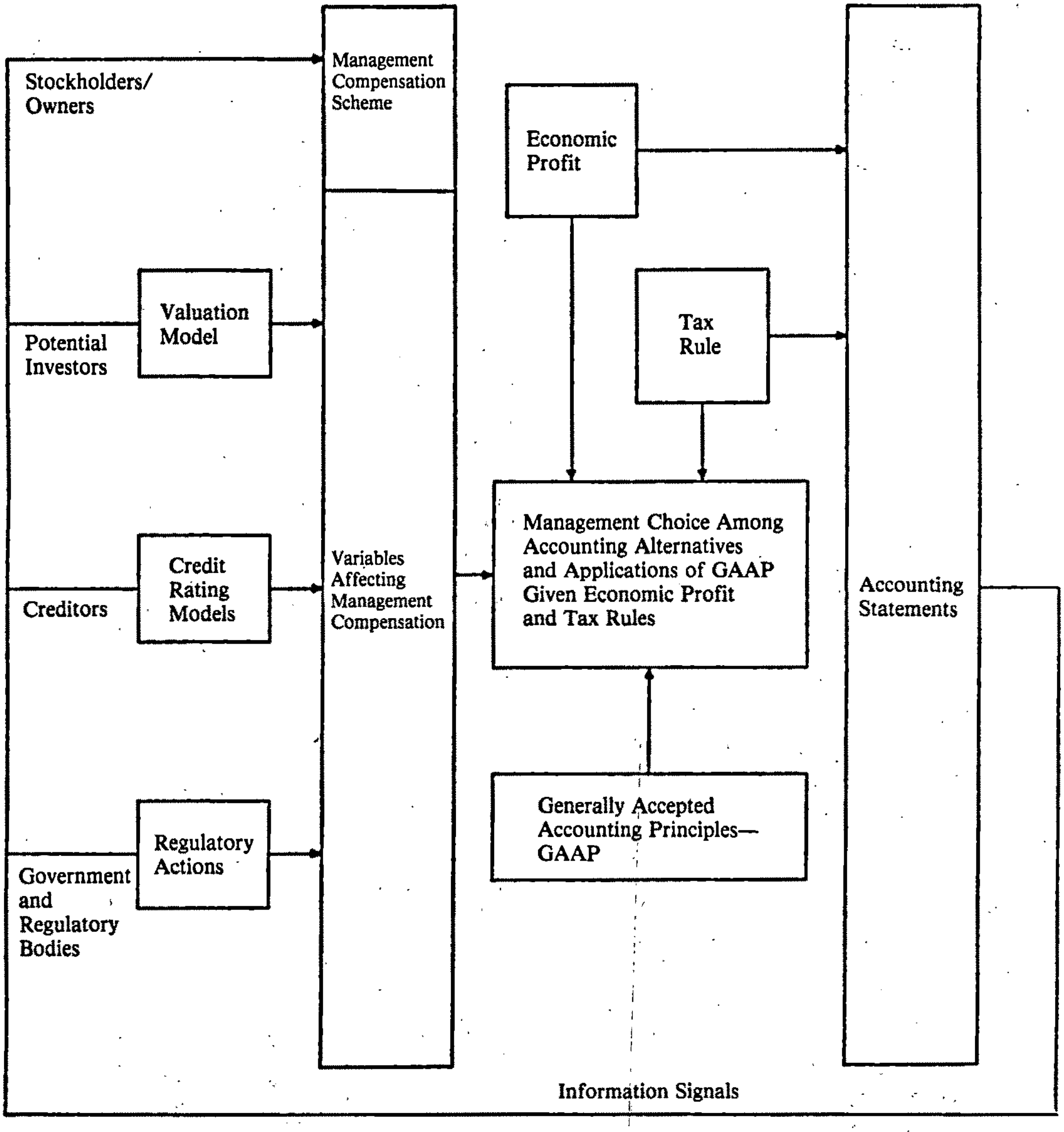
[1] Proofs can be obtained from the authors.

FIGURE 1

THE PRODUCTION OF ACCOUNTING SIGNALS: AN INCENTIVE SCHEME PERSPECTIVE


Stockholders/ Owners
Potential Investors
Valuation Model
Creditors
Credit Rating Models
Government and Regulatory Bodies
Regulatory Actions
Management Compensation Scheme
Variables Affecting Management Compensation
Economic Profit
Tax Rule
Management Choice Among Accounting Alternatives and Applications of GAAP Given Economic Profit and Tax Rules
Generally Accepted Accounting Principles— GAAP
Accounting Statements
Information Signals

which lasts for two periods[2] (0 and 1) who delegate operations to a risk neutral manager (with no initial ownership interest). No debts exist and no interim dividend is distributed. The only tax in the system is a fixed proportional corporate income tax, t. Exerting only minimal effort and in the absence of bonus or option, the manager (MGR) generates cash flows I_0 and I_1 (the subscripts refer to period 0 and period 1, respectively). With a bonus ($0<\alpha<1$, multiplied by accounting income) and an option granted at time 1 (end of period 0) to acquire γV_0 ownership (where V_0 is the firm value at time 1, $0<\gamma<1$) exercisable at time 2 (end of period 1) but not earlier, MGR generates cash flows in the magnitude of $\bar{I}_0=I_0\psi$ where $\psi=1+\epsilon(\alpha+\gamma)-\epsilon/2(\alpha^2+\gamma^2)$ and ϵ is a positive constant.[3] MGR has private information in that MGR observes $\bar{I}_0$ and accurately foresees $\bar{I}_1$ at time 1. Owners, however, observe separately[4] $\bar{I}_0$ and $\bar{I}_1$ only in time 2 (end of period 1—liquidation) and hold a prior probability distribution of $\bar{I}_0$, $H(\bar{I}_0)$ and of the firm growth $F(\bar{I}_1/\bar{I}_0)$. These distributions can be used to illustrate how owners might determine α and γ at time 0 (beginning of period 0) as shown below. Accounting choice is captured by a scalar A which operates proportionally on $\bar{I}_0$ to produce accounting income $A\bar{I}_0$.[5] To value the firm at time 1, owners form an expectation of $\bar{I}_1$ ($=\bar{I}'$), which they set equal to $A\bar{I}_0$. That is, income is viewed as following a strict martingale proess, in accord with such empirical evidence as produced, e.g., by Ball and Watts [1972] and Watts and Leftwich [1977].[6] MGR faces a penalty for inaccuracy of $(\beta/\bar{I}_0)(\bar{I}_1-A\bar{I}_0)^2$. We do not derive an optimal incentive scheme (or an optimal penalty function). Indeed, given the assumption of perfect observability of the outcome of time 2, at the liquidation of the firm, an optimal penalty would have elicited the truth. However, the model's assumption that true income is observed at the end of period 2, is itself not realistic and was intended to make a solution possible. Since modeling an ongoing concern over multiple periods is extremely difficult, some simplification needs to be made to make the model tractable. Hence, in reality, an optimal penalty assuming such liquidation would not have been realistic.

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[2] In the reality of a going concern, of course, no clear-cut settling up is possible as outcome (past plus potential cash flows) is not observable. This unobservability, coupled with information asymmetry endows accounting income numbers with a signalling content. Hence, more than one period must be assumed to require the reporting of accounting income.

In fact, given the linearity of the contract, the optimal penalty would be any arbitrarily large constant levied upon any departure from the (eventually) observable truth. In practice, such a penalty may not be enforceable as the wealth of managers is bounded and, hence, private contracting may not be feasible under the circumstances. Thus, we observe the incidence of state-imposed penalties such as nonconserving procedures like incarceration and other resource-wasting punishments.

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[3] ψ can be interpreted as reflecting effort induced by the compensation scheme, $\psi_\alpha>0$, $\psi_{\alpha\alpha}<0$, $\psi_\gamma>0$, $\psi_{\gamma\gamma}<0$, invoked here conceptually to rationalize the observed (from responses to questionnaires) inclusion of bonus and options in compensation. This is in accord with evidence such as presented by Murphy [1985] documenting linkage between managerial performance and total compensation (including bonus and options) and with principal-agent models (e.g., Holmstrom [1979]) in light of the informativeness of accounting income and stock prices as corroborated by the many *event* and *market efficiency* studies. It can be shown that the derived sign of the tax effect on accounting choice (the testable implication) is invariant to the specific functional form of ψ (assumed here to attain solution specificity) and is preserved even if the effort function were omitted: it suffices to assume some $\bar{I}_0$ for a given α and γ.

[4] This assumption can be relaxed allowing for *ex post* knowledge of only the sum of the cash flows ($\bar{I}_0+\bar{I}_1$) without changing the derived sign of the tax change. It can also be shown that an assumption that owners observe $\bar{I}_0$ at time 1 will not affect the derived sign of the tax change effect. Specifically, under most plausible conditions, they will prefer to use accounting income as a signal of $\bar{I}_1$ rather than applying their prior knowledge about ($\bar{I}_1/\bar{I}_0$) to the observed $\bar{I}_0$. But, note that the assumption adopted in the model (owners do not observe $\bar{I}_0$ at time 1) rules out the observation by them of the accounting choice. In practice, while some accounting choices are disclosed, many are not (consider the many possible estimates of useful life, methods of deferring revenue, a variety of smoothing techniques, etc.).

[5] That is, the accounting choice can be captured by a real number within a closed interval defined by GAAP. Underlying this assumption is the possibility of a rich set of accounting treatments among which the manager can exercise discretionary choice. Given the observed cash flows, the manager can combine such accounting treatments as would produce a real number within the GAAP-allowed interval, which, when multiplied by $\bar{I}_0$ will produce the desired accounting income. Thus, A can be interpreted as a bounded real-valued function defined on subsets of accounting methods whose existence is made possible by the richness of the underlying set of possible accounting treatments. That set is, in fact, the cartesian product set of n-tuples with n financial statement items and with m_j possible accounting treatments for each item $j(j=1,2,\ldots,n)$.

[6] However, it can be shown that any prediction function under which $\bar{I}'$ is monotone increasing, linear or convex, in accounting income will not change the derived sign of the tax effect so long as the bounded and injective penalty is convex in A.

The purpose of the assumed penalty function is to mimic the penalties that might be perceived by corporate managers in reality. Discussions with litigators of suits against corporate directors and officers indicate that suits arise primarily when income fluctuates and, in particular, when it decreases significantly. Further, the larger the deviations, the larger the apparent impact on stock prices, the larger are likely to be the damages suffered and claimed by investors, and the larger the settlements. For tractability, the penalty was assumed symmetric and proportional to squared error. This penalty function is representative of a large class of penalty functions that are generally realistic. Indeed, it can be shown that any injective and bounded penalty that is convex in A will preserve the implied impact of tax on accounting choice as long as the cash flow predicted by investors $\bar{I}'$ is monotone increasing and linear or convex with accounting income. One would expect a convex penalty function in practice, as extreme deviations of income from what is expected will generally cause more extreme penalties (possibly in the form of legal case settlements). And a penalty represented by a step function that imposes a large levy only if income is considerably overstated and no or little levy otherwise (as in the typical case of litigations only when income is drastically down) can be approximated by convex functions that will yield the same implications. Note also that the implications are not altered with changes in the β parameter specified in the penalty function. This parameter can also be viewed as incorporating the probability perceived by the manager to be attached to incurring the penalty.

Corresponding to A, tax rules of measurement are represented by a scalar Z, such that taxable income for period 0 is $Z\bar{I}_0$. The terminal value of the firm at time 2, V_1 is assumed to exceed V_0.[7] Tax rate changes are viewed as surprises—unanticipated in advance by MGR or the owners. Finally, these specifications are common knowledge as of time 0 and can be summarized in the event sequence (Exhibit 1).

We distinguish between conformity ($A=Z$) and nonconformity ($A \neq Z$). Choice among accounting alternatives is generally conducted within a context of nonconformity. Only the choice of inventory valuation method is subject to conformity in that LIFO can be used for tax purposes only if it is also applied for financial reporting purposes. The flexibility of choice accorded managers with respect to all other (than inventory valuation) accounting treatments makes it practical to analyze the impact of tax on accounting choices within an environment of nonconformity. We analyze both cases because a comparison of the implications of conformity with those of nonconformity could be pertinent to the evaluation of the Internal Revenue Service policy of sometimes considering the requirement of conformity with respect to accounting treatments.

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[7] Since the terminal value of the option at time 2 is $\text{Max}[0,\gamma(V_1-V_0)]$, this assumption allows it to be expressed as $\gamma(V_1-V_0)$. Because of the option's nonmarketability, as the information gathered from the companies in the sample revealed, the option is different from the one described by Black and Scholes [1973].

EXHIBIT 1

THE EVENT SEQUENCE

Activity Period	*0*		*1*
Time:	0	1	2
Events:	Owners have available to them distribution functions $H(\bar{I}_0)$ and $F(\bar{I}_1/\bar{I}_0)$ and set contract parameters α and γ	$\bar{I}_0$ Realized and observed by manager. $\bar{I}_1$ accurately foreseen by manager A chosen by manager $A\bar{I}_0$ Reported V_0 Established	$\bar{I}_1$ Realized and observed by owners. $\bar{I}_0$ observed by owners

Solution

Given the cash balance at time 1 $(\bar{I}_0-\alpha A\bar{I}_0-(Z\bar{I}_0-\alpha A\bar{I}_0)t)$, and under conformity, V_1 becomes:

$$V_1^c=[\bar{I}_0-\alpha A\bar{I}_0-(A\bar{I}_0-\alpha A\bar{I}_0)t][1+r(1-\alpha)(1-t)]+\bar{I}_1-(\bar{I}_1+\bar{I}_0-A\bar{I}_0)(\alpha+t-\alpha t) \quad (1)$$

while under nonconformity:

$$V_1^n=[\bar{I}_0-\alpha A\bar{I}_0-(Z\bar{I}_0-\alpha A\bar{I}_0)t][1+r(1-\alpha)(1-t)]+\bar{I}_1-(\bar{I}_1+\bar{I}_0-A\bar{I}_0)\alpha-[(\bar{I}_0+\bar{I}_1)(1-\alpha)-Z\bar{I}_0+\alpha A\bar{I}_0]t. \quad (2)$$

V_0 is obtained by discounting V_1 at the rate r and with $\bar{I}_1$ (not observed by owners at time 1) replaced by $\tilde{I}'$ and with $\bar{I}_0$ replaced by $\tilde{I}$, the expectation under $H(\bar{I}_0)$. Thus, under conformity we have:

$$V_0^c=\{[\tilde{I}-\alpha A\bar{I}_0-(A\bar{I}_0-\alpha A\bar{I}_0)t][1+r(1-\alpha)(1-t)]+\tilde{I}'-(\tilde{I}'+\tilde{I}-A\bar{I}_0)(\alpha+t-\alpha t)\}\lambda \quad (3)$$

and under nonconformity:

$$V_0^n=\{[\tilde{I}-\alpha A\bar{I}_0-(Z\bar{I}_0-\alpha A\bar{I}_0)t][1+r(1-\alpha)(1-t)]+\tilde{I}'-(\tilde{I}'+\tilde{I}-A\bar{I}_0)\alpha-[(\tilde{I}-\tilde{I}')(1-\alpha)-Z\bar{I}_0+\alpha A\bar{I}_0]t\}\lambda \quad (4)$$

where $\lambda=1/(1+r)$.

Note that the owners are fully aware that MGR will choose A that will maximize his or her present value and, hence, are not duped into using the imperfect signal $A\bar{I}_0$ in the determination of V_0 for either fixing the option's price or for portfolio recomposition decisions. Rather, being aware of the nature of information asymmetry, the owners decide to use the manager's signal, $A\bar{I}_0$ to formulate expectations about future cash flows, while simultaneously designing α and γ optimally within their linear contract, and in light of the existing penalty function (induced by potential stockholder and SEC litigation) so as to minimize misrepresentation to an extent that is consistent with their wealth maximization.

After appropriate substitutions, the present value, at time 1, of the manager's total compensation (denoted M) can be shown to be:

$$M=\alpha A\bar{I}_0+(\bar{I}_1+\bar{I}_0-A\bar{I}_0)\alpha\lambda+\gamma\lambda(V_1-V_0)+\lambda\alpha r[\bar{I}_0-\alpha A\bar{I}_0-(Z\bar{I}_0-\alpha A\bar{I}_0)t]-\lambda\beta(\bar{I}_1-A\bar{I}_0)^2/\bar{I}_0. \quad (5)$$

With α and γ given, the manager maximizes equation (5) with respect to A

(yielding A^*) under conformity:

$$A_c^* = I_1/I_0 + \{\alpha r(1-\alpha)(1-t) + \lambda\gamma(1-\alpha)(1-t)[r^2(\alpha t-\alpha-t) - 1]\}/2\beta \qquad (6)$$

and under nonconformity:

$$A_n^* = I_1/I_0 + \{\alpha r(1-\alpha+\alpha t) + \lambda\gamma[(1-\alpha)(1-t)\{-\alpha r^2(1-t) - 1\}]\}/2\beta. \qquad (7)$$

The comparative static analysis (in the short-run) in this paper with regard to the sensitivity of A^* to t and other parameters does not depend on the optimal determination of the exogenously given α and γ. But an equilibrium solution triple (α^*,γ^*,A^*) is required to derive long-term implications (such as when either because of elapsed time or reduced renegotiation costs α and γ are optimally adjusted to change in t).

α^* and γ^* are chosen by owners at time 0 so as to maximize the present value of their time 2 terminal wealth, correctly anticipating MGRs determination of A^*, using the α and γ specified in his time 0 contract as parameters. V_M (the present value maximized by the owners at time 0) will, thus, equal the present value of the terminal value of the firm minus the present value of MGRs option:

$$\text{Max}_{\alpha,\gamma} \quad V_m = [V_1 - \gamma(V_1 - V_0)]\lambda^2 \qquad (8)$$

subject to $A^* \in \text{Argmax } M$.

Explicit expressions for both α^* and γ^* are difficult to obtain. It is possible, however, to derive an explicit expression for γ^* with multiple solutions for which α^* can be found implicitly.[8] Because of the analytical complexities, the results of numeric analysis will be presented below to characterize the equilibrium (α^*,γ^*,A^*).

Short-Run Analysis

Here, we adopt a short-run perspective and focus on the sensitivity of A^* to t and other parameters of interest when owners are assumed not to optimally adjust α and γ in the short-run in light of exogenous shocks in t. Such a scenario becomes realistic from an empirical standpoint if renegotiation of the parameters α and γ in the compensation contract is either too costly or time consuming.

Under conformity we have:

$$\frac{\partial A^{*c}}{\partial t} = [(\alpha-1)/2\beta][\alpha r + \lambda\gamma\{2r^2(\alpha t-\alpha-t) - 1 + r^2\}]. \qquad (9)$$

Analysis of equation (9) reveals that when α is substantially higher than γ, then $\partial A^{*c}/\partial t < 0$ and vice versa when α is small. Figure 2 depicts this relation for $t=.5$ and $r=.1$. When γ is small (.01 only) $\partial A^{*c}/\partial t$ is almost always negative (except for extremely small αs). If, however, γ is large (approximately .11 in our setting) $\partial A^{*c}/\partial t$ is always positive for any size of α. When, for example, γ equals 0.05, $\partial A^*/\partial t$ changes sign around $\alpha=.5$.

This suggests that, under conformity, a MGR who owns an option to buy a large portion of the firm will, *ceteris paribus*, make more use of income-increasing accounting treatments given a high corporate tax rate; however, if the size of his or her option is small, MGR will more intensively use income-increasing accounting treatments when the bonus is small (small α) and will more intensively use income-decreasing accounting treatments if the bonus is large (large α). When the option is large and tax is increased, the option's value relative to the

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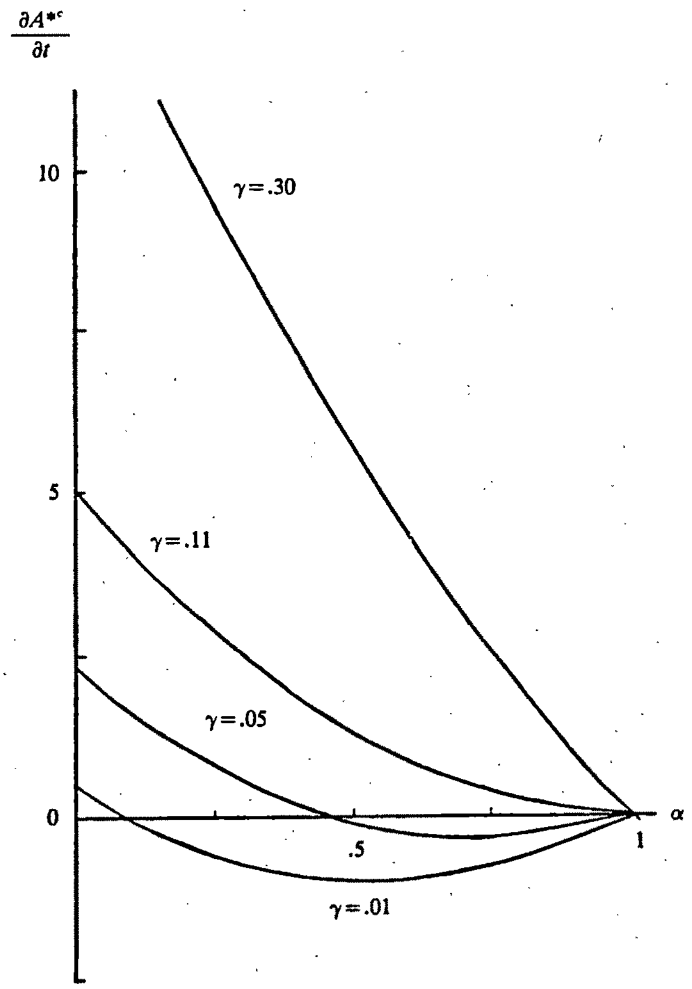
[8] The analytical derivations that yield the equations for α^* and γ^* are cumbersome and can be made available upon request in computer output form. The analytical solution was derived by making use of MACSYMA—a computer program which derives highly sophisticated solutions to analytical algebra. The program was developed at MIT and was applied in this research with the help of the Courant Institute of Mathematical Science at New York University.

FIGURE 2

THE SENSITIVITY OF THE ACCOUNTING MIX TO A TAX CHANGE UNDER DIFFERENT COMPENSATION SCHEME PARAMETERS WHEN ACCOUNTING AND TAXABLE INCOME ARE THE SAME



α=Bonus applied as a percentage of accounting income
γ=Percentage of firm value at time 1 granted as option to MGR
t=Corporate tax rate
A^{*c}=Optimal accounting choice under conformity

bonus is reduced and *A* will increase (even though it further reduces the value of the option) under the new equilibrium. On the other hand, when the option value is very small relative to the bonus, the impact of a tax increase on the manager's share of the interest income the firm earns in period 1 becomes more important relative to the option value and the bonus, and a tax rate increase induces a decrease in *A* to mitigate the adverse effect of the tax on the manager's share of the corporate interest income. These results are due to the intricate interplay between the bonus and options under conformity.

Under nonconformity we have:

$$\begin{aligned}\frac{\partial A^{*n}}{\partial t} = \alpha^2 r/2\beta + [\lambda\gamma/2\beta](1-\alpha) \\ [2\alpha r^2(1-t)+1] \qquad (10)\end{aligned}$$

since α, β, γ, and t are all positive and smaller than 1, and assuming $I_0 > 0$ we can conclude that $\partial A^{*n}/\partial t > 0$, implying that under nonconformity, an increase in corporate income tax will increase the use of income-increasing accounting treatments and, conversely, when the tax rate is decreased, income-decreasing accounting treatments will be used. Intuitively, at the margin, an increase in corporate income tax rate decreases the value of the option relative to the bonus. Since the corporation is taxed based on a number that differs from accounting income, an increase in A improves (at the margin) the bonus without substantially affecting the value of the option; subsequently, managers will increase A under the new equilibrium. Of course, under the new equilibrium, the expected penalty will also change with a change in A, with the direction of change depending on $\bar{I}_1/\bar{I}_0$.

As to parameters other than t, numerical analysis shows A^{*c} (the A maximizing M) to be sensitive to both α and γ, with higher degree of sensitivity exhibited to γ. An increase in γ decreases A^{*c} (i.e., will induce managers to increase the use of income-decreasing accounting treatments), whereas an increase in α increases A (an increase in the manager's bonus will trigger an increased use of income-increasing accounting treatments). Also, A^* increases with an increase in $\bar{I}_1$ and the rate of discount (but is not very sensitive to the latter).

Long-Run Analysis

Numerical analysis was conducted to determine the sensitivity of the equilibrium $(\alpha^*, \gamma^*, A^*)$. For every given t, 10,000 (α, γ) pairs (with α and γ each varying in intervals of 0.1) within [0,1] were used to derive $A_t^*(\alpha, \gamma)$ and $Vm_t(A^*, \alpha, \gamma)$ for assigned values of the constants I_0, I_1, β, and ϵ. Pairs $\{\alpha^*(t), \gamma^*(t)\}$ that maximized Vm_t were then identified. With each pair is associated an A_t^* that maximizes M_t. The resulting equilibrium path of the triple $(\alpha^*, \gamma^*, A^*)$ in t shows (under conformity) that A^{*c} increases generally and over most of the domain with t in a stepwise fashion. Under nonconformity, A^{*n} is shown to be nondecreasing in t over all the domain. Different parameters were used with similar results under both conformity and nonconformity.

Since, with the exception of the FIFO-LIFO choice, no conformity is required, one would expect A^* to generally increase with t, even under continuous and instantaneous adjustment of the compensation scheme parameters α^* and γ^*. As noted above, increase in t decreases the option's value (relative to the bonus) and, under nonconformity, realignment of the equilibrium toward increased bonus and, thus, increased A^* is intuitively appealing. Note the implication that, at the margin, A will increase even if it is in excess of $\bar{I}_1/\bar{I}_0$, thus incurring higher penalty, as the expected marginal penalty would be more than offset by the expected marginal increase in bonus given the increase in the tax rate.

III. EVIDENCE ON ACCOUNTING CHOICE

Development of Hypotheses

The analysis in Section II leads to the following testable (in principle) hypotheses.

(1) In the case of nonconformity, a higher corporate income tax rate will be associated with accounting choices that tend to increase reported earnings. That is, such a relation is expected to be observed in both the short-run (α^* and γ^* are not adjusted contemporaneously with change in t) and the long-run (α^* and γ^* are adjusted contemporaneously with change in t).

(2) Under conformity, and in the short-run, the relation between the corporate tax rate and the accounting mix depends on the compensation scheme. If γ is large, $\partial A^{*c}/\partial t$ is always positive; if γ is small, $\partial A^{*c}/\partial t>0$ for small αs, and $\partial A^{*c}/\partial t<0$ for large αs.

Since, excepting the FIFO-LIFO choice, no conformity is required[9] (and, thus, a case of nonconformity can be viewed to prevail generally), and since no independent empirical evidence is available regarding whether the short-run or the long-run scenario obtains, implication (1) above (invariant under both scenarios) is more pertinent and encompassing. To a limited extent, implication (2) can be viewed as a joint hypothesis that (a) a short-run scenario obtains and (b) the FIFO-LIFO choice, which requires conformity, is treated differently from other methods (which do not require conformity).

For the purpose of the test, we focus on accounting methods that are easily identifiable and relatively simple to evaluate. The accounting methods selected were the inventory valuation method (FIFO vs. LIFO) which represents the only case of conformity, depreciation method (accelerated vs. straight line), the treatment of the investment tax credit (flow-through vs. deferral), the method of amortization of past service pension costs (long vs. short period of amortization), and finally, the treatment of interest on long-term projects developed within the firm (capitalization vs. noncapitalization). Of course, differences in these methods applied across firms do not reflect all the differences in accounting treatment, and to this extent, our ability to interpret the results would be somewhat limited.

Under hypothesis (1) and independent of the compensation schemes, a higher effective tax rate will be associated with the use of an income-increasing mix of techniques (that is, firms would tend to use straight-line depreciation, flow-through method for the treatment of investment tax credit, a long period for the amortization of past service pension costs, and the capitalization of interest costs). Given the nature of the sample—stable or growing firms in an inflationary period—it is safe to maintain that this mix would be income increasing. The choice of these accounting alternatives will have affected the entire multi-period distribution of earnings, but, as Hagerman and Zmijewski [1979] did, we assume that management could switch when the alternative being employed was no longer useful. Ideally, one should assign appropriate weights to each of the accounting choices whose impact on reported earnings may differ. However, because of substantial variations in such possible impacts across firms and industries, this was not feasible.

Data

Unlike inventory and depreciation methods, the accounting treatment of other items was not always disclosed in the corporate annual reports. Therefore, a questionnaire eliciting this and, also, data on compensation schemes, was mailed to the *Fortune* 1,000 largest companies. Two hundred two companies responded but only 145 disclosed their names. Telephone follow-ups were used to obtain missing information from corporate controllers. Where some of the data could not be obtained (such as when a company did not disclose its name and submitted only a partial response) the company was excluded from the sample. The data covered the fiscal year ending December 31, 1979 (the Appendix shows the distribution of the responding companies by volume of sales and industry). Thirteen companies reported an option plan only (group 1), 37 a bonus plan only (group 2), 142 a mixed bonus option plan (group 3), and 10 neither a bonus nor an option plan. These data pertain to explicit contracts only and they do not reflect implicit arrangements that are not written into contracts.[10]

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[9] This will not be valid in the future under the "Alternative Minimum Taxation" provisions under Section 55 of the Internal Revenue Code of 1986.

Method

The primary independent variable of interest is the corporate effective tax rate. Because the tax rate varied little over time with no apparent shocks, a cross-sectional regression was used. Firm-size is introduced as a second explanatory variable in one of the regressions. The dependent variable (accounting choice) is dichotomous with respect to each of the accounting methods selected. Thus:

$$Y_i=\alpha+\beta X_i+U_i$$

where $Y=1$ if the accounting method tends to increase income and $Y=0$ if the method tends to decrease income; X_i is the company i's effective average tax rate. The model assumes a constant tax rate, i.e., marginal tax rate = average tax rate = a constant. The tax rate is specifically modelled as an average tax rate which multiplies taxable income and is independent of its magnitude. Therefore, the proper empirical representation of the tax variable is the empirically observed (effective) average tax rate. As the empirical analysis is based on a cross-sectional regression and not a time-series, changes in the average tax rate examined in the model are empirically represented as cross-sectional variations in the average tax rate across the companies in the sample.

Because the dependent variable is dichotomous, a logit transformation was used where possible.[11] Otherwise, for cases in which the samples are too small for use of logit, heteroscedasticity was largely removed by scaling the variables by the standard deviation of the error terms in a weighted least squares regression.

Since it is necessary to observe the joint effect of tax on the *mix* of accounting choices and not on each separately, the (0,1) values assigned to treatments are summed over the (k) treatments used in each regression. The combined dependent variable, thus, obtains a value ranging between 0 and k;[12] then 0 is assigned

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[10] Additional data limitation forced us to use (with the exception of group 1) smaller samples in the tests as explained below.

[11] Logit transformations are appropriate whenever the modelling involves discrete, or qualitative, dependent variables. A comprehensive description of logit modelling is provided in Hanushek and Jackson [1977] or Fienberg [1980]. Snedecor and Cochran [1976, p. 494] suggest that the logit transformation is advisable when each cell contains 20 or more observations.

[12] For some treatments, values between 0 and 1 are possible. For example, the amortization of past service pension cost is allowed over a period of 10, 20, 30, or 40 years. We give ten years the value of 0, 20 the value of 1/3, 30 the value of 2/3, and 40 the value of 1. Similarily, the combination of two depreciation methods may yield a value between 0 and 1 to the extent that the proportion of each method could be identified.

(to the dependent variable) if such value is smaller than or equal to $k/2$ and 1 is assigned otherwise. Thus, the mix of k accounting methods is now reflected in the combined dependent variable. This procedure arbitrarily assigns equal weight to each treatment. Zmijewski and Hagerman's [1981] evidence indicates that the results are not likely to be sensitive to arbitrary assignment of weights to different treatments.

Two observations are noteworthy at this point. First, because we were not able to obtain the precise magnitudes of α and γ from the companies that responded to the questionnaires, these are not included as independent variables; but note that their impact on the implications of the tax rate for accounting choice is incorporated in the model as they are allowed to vary optimally with the variations in the tax rate within the long-run analysis. Hence, the hypothesized sign of the coefficient is not affected by their omission. What is affected by the omission is the estimated magnitude of the tax rate coefficient—it will be biased to the extent that α and γ are not independent of the tax rate (see, e.g., Maddala [1977, p. 156]) as, by the very nature of the equilibrium, one does not expect them to be. Without data on α and γ, it is not possible to estimate the bias *empirically*. However, numerical analysis of the equilibrium triple (α^*,γ^*,A^*) reveals negative (positive) association between $\alpha^*(\gamma^*)$ and t; and from the short-run numerical analysis reported in Section II above, the theoretical coefficients of α and γ as independent variables in a regression with A^* as a dependent variable should be positive and negative, respectively. Hence, the *theoretical* bias is negative [Maddala, 1977, p. 156]. In other words, the estimated coefficient of the tax rate would be biased downward and its variance upward. Thus, in a test for a positive sign, we would have a conservative test, both of the sign and of the significance of the coefficient. As to the short-run case, since α and γ are assumed to be constant relative to t, the estimated coefficient is expected to be unbiased.

Second, the model abstracts from variables such as covenant constraints as cited by Daley and Vigeland [1983] to affect accounting manipulations and, in particular, the decision as to whether to capitalize or expense research and development costs. But noninclusion of such variables is unlikely to confound the empirical results, since closeness to covenant constraints is not likely to be systematically related to tax rates; hence, the tax rate coefficient would still be unbiased, although its estimated variance will be upward biased. This will result in a conservative test of significance for the coefficient.[13]

The sample of companies was divided into three groups: those with a stock option plan, those with a bonus plan, and those combining option and bonus.

Specific Tests and Results

The Case of Conformity—Short-Run Scenario. For the option only (group 1) the implication of the model is that $\partial A^{*c}/\partial t$ is always positive (including the treatment of inventory, see the statement of hypothesis (2) above). Therefore, the inventory method is combined with the others into a dependent variable which reflects all methods ($k=5$). For this group, a positive relation between the dependent variable and the effective tax rate[14] is expected.

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[13] Suppose it is argued that closeness to covenant constraints implies that the company suffered cumulative losses and, hence, had available to it loss carryforwards that reduced the effective average tax rate during the year of the empirical test. This negative correlation coupled with the documented positive association between closeness to covenance constraints and choice of income-increasing accounting choices would bias the tax coefficient downward and result in a conservative test of the sign of the coefficient.

Group 2 (bonus plan only) is subdivided into (1) companies selecting all accounting treatments consistently in the same direction (either income increasing or income decreasing), and (2) companies selecting accounting treatments in opposite directions (each company selecting some income increasing treatments and some income decreasing ones). For the first subgroup (companies with consistent choices) it is assumed that the A^* obtained is a corner solution and that the inventory method is chosen to increase income when the other accounting treatments increase income and vice versa. In other words, the companies were assumed to obtain their optimum either at the maximum A or the minimum A and, hence, to want to use all accounting choices to attain either of the extreme points. Accordingly, the inventory method was combined with the other into a joint dependent variable ($k=5$) that is expected to be positively associated with the effective tax rate. As to the second subgroup, A^* is assumed to be interior so that the inventory method would be chosen so as to change income in a direction opposite to that of the other methods. For this subgroup, a separate regression is run for the inventory method with a dependent variable assuming 0 or 1 (LIFO or FIFO), expected to be negatively associated with the tax rate. The dependent variable combining the four remaining methods characterized by nonconformity was, however, expected to be positively associated with the tax rate.

Out of the 13 companies of the first subgroup, four did not disclose all the required data. To increase the sample, six more companies that did not pay bonuses to their management in 1979 were identified (from *Business Week* [May 12, 1980]) thus, bringing the sample size to 15. Because of its small size (where logit is not applicable) a weighted least square regression whereby all the variables were divided by the standard deviation of the error term, was run (see regression 1 in Table 1). The coefficient, while positive, is not statistically significant, and augmenting the sample with 11 companies with a small bonus (less than one percent of net profit) and a large option (more than one percent of outstanding stock) still failed to yield statistical significance. Weighted least square regressions 2 and 3 (Table 1) featuring, respectively, the inventory method and the combined remaining four methods of the 33 companies of the second subgroup (four ineligible observations were deleted), also yield coefficients with signs as expected, but not statistically significant.

The Case of Nonconformity. The short-run scenario analysis of Section II implied that $\partial A^{*c}/\partial t$ can be either positive or negative in the case of conformity (only the inventory method). But, since only the choice of LIFO for inventory is subject to conformity, the five treatments taken as a whole (including the inventory method) can be combined to reflect a choice of accounting mix under nonconformity. Under a long-run scenario as well, A^* always increases in t. Therefore, it is hypothesized that the dependent variable combining all five methods is positively associated with the effective average tax rate. Regression 4 in Table 1 shows the weighted least

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[14] As of December 31, 1979, the effective corporate income tax rate differs from the statutory rate due to different state and local taxes, different size of investment tax credit, and some minor items. Thus, different corporations are subject to different effective tax rates. The effective rate used here is the ratio of income tax effectively paid over taxable income (as reported in the 10-Ks). Five companies in the sample reported a negative effective tax rate and were omitted.

TABLE 1

ASSOCIATION BETWEEN ACCOUNTING CHOICE AND EFFECTIVE TAX RATE
RESULTS OF WEIGHTED LEAST SQUARES REGRESSION

$$Y_i=\alpha+\beta X_i+U_i$$

	Group		*Binary Dependent Variable*	*Expected Sign of*	*Estimated Coefficients (t-statistics, one-tail)*			
Regression	*Description*	*n*	*(0 or 1)*	*Coefficient*	*Intercept*	X	R^2	F-*statistic*
1	1 (Option Only)	15	All Methods	+	.925	.360	.12	.17
			(k=5)		(1.14)	(.406)		
2	2 (Bonus Only)	33	Inventory	−	1.301	−.498	.01	.31
					(1.61)	(−.55)		
3	2 (Bonus Only)	33	All But Inventory	+	1.562	1.119	.05	1.58
			(k=4)		(.20)	(1.26)		
4	3 (Bonus and Option)	102	All Methods	+	.385	.974	.04	4.00
			(k=5)		(.85)	(2.00)*		

Y_i=Accounting Choice of Firm i
X_i=Effective Average Tax Rate of Firm i
* Significant at the .025 level

square results for the mixed bonus option companies whereby the dependent variable combines all five methods. Only 102 companies (out of the original 142 in this group) for which the necessary information was available has been included in this regression. The coefficient of the tax rate is positive as hypothesized and significant at the 0.025 level.

Because of the relatively larger number of the mixed bonus option companies, it was possible to use the logit test (with standard-deviation-scaled variables) in Table 2. Regression 1 in Table 2 yields a coefficient that is positive (as expected) and significant at the one percent level.

Watts and Zimmerman [1978] argue that the bigger the company, the more it is exposed to political pressure, and the more it will tend to reduce its reported earnings. They presented responses of companies to an income-decreasing standard proposed by the Financial Accounting Standards Board that were consistent with the political pressure hypothesis. This may imply that large corporations, even when facing a high tax, will not necessarily prefer accounting methods that tend to increase reported earnings since political costs could exceed the benefits. Table 2 features a logit test using sales as a second explanatory variable (a surrogate for size) which has correlation with the tax rate of approximately 0.01.

Results when assets surrogated for size were very similar and are, therefore, omitted. The tax rate coefficient is positive, whereas the sales coefficient is negative; both are statistically significant at the .025 level or higher. However, the negative coefficient attached to sales could be explained in terms of equations (6) and (7) *without* invoking potential political pressures: if large firms are associated with smaller growth (in the sense of relatively small I_1/I_0) they would select a lower A^* than would smaller size firms with possibly larger I_1/I_0. Note that such association is not

TABLE 2

ASSOCIATION BETWEEN ACCOUNTING CHOICE AND EFFECTIVE TAX RATE
RESULTS OF WEIGHTED LOGIT REGRESSION FOR COMPANIES WITH
MIXED BONUS OPTION PLANS CONSIDERING ALL FIVE ACCOUNTING METHODS
$(n=102)$

Regression 1: $Y_i=\alpha+\beta X_i+U_i$
Regression 2: $Y_i=\alpha+bX_i+cS_i+\omega_i$

Regression	*Expected Sign of Coefficients*	*Estimated Coefficients (t-statistic, one-tail)*			R²	*F-statistic*
		Intercept	X	S		
1	+	−.098 (−.47)	1.261 (2.32)**		.57	5.40
2	X: + S: −	−.757 (−1.47)	2.841 (4.61)***	−.000002 (−1.96)*	.70	10.67

Y_i = Accounting Choice of Firm i
X_i = Effective Average Tax Rate of Firm i
S_i = Sales for Firm i
* Significant at the .025 level
** Significant at the .01 level
*** Significant at the .001 level

independently observable, as I_1/I_0 represents the ratio of "effortless" true cash flow.

IV. CONCLUDING REMARKS

This paper shows the existence of an equilibrium solution to the managers' and the owners' maximization problem involving choice of the accounting operator on the part of the manager and choice of the compensation parameters on the part of the owners, when the compensation scheme is linear. Optimality of the compensation scheme was not of concern. The analysis focuses on the sensitivity of the optimal accounting solution to changes in the tax rate and some other parameters of the problem. The main conclusion drawn from the model is that in the case of "nonconformity," a higher corporate income tax rate will be associated with an income-increasing accounting mix. In the case of "conformity" and in the "short-run" (before α^* and γ^*, the optimal bonus and option, respectively, are optimally adjusted following a tax rate change), the results depend on the structure of the managers' compensation scheme; if the option is relatively large, the use of income-increasing accounting treatments is positively related to the tax rate, while if the option is relatively small, the relationship is positive when the bonus is small, and negative when the bonus is large. Nonetheless, since managers operate in an environment whereby the only item treated under "conformity" is inventory, we hypothesized that, in general, the optimal accounting operator increases with an increase in the tax rate and, conversely, decreases with a decrease in the tax rate.

Some remarks on the optimal accounting choice are noteworthy. First, the optimal accounting choice is more sensitive to the specification of the option plan (the proportion of the firm's value offered in the form of option) than it is to the specification of the bonus (the percentage of reported income distributed as a bonus to the manager).

Second, compensation schemes as specified in our model do not seem to be sufficient to guarantee an interior solution for the accounting operator that is consistent with owners' wealth maximization. Some penalty for inaccuracy in conveying expectations appears necessary. This is consistent with the observation of penalties associated with potential litigation costs and losses inherent in suits against managers, as well as reputation effects. While the social arrangement imposing such penalties is exogenous to our system, it is nonetheless endogenous to a global framework wherein owners and others lobby for the arrangement in their own self-interest.

Third, even with this penalty, the accounting policy is sensitive to the specification of α and γ, and moreover, A, the accounting operator (the choice among accounting treatments) is important for owners as a signal of managers' expectations.

Fourth, the sensitivity of the optimal accounting choice to tax rate change differs as between cases of conformity and nonconformity. This implies that, in policy deliberations, the Internal Revenue Service and accounting regulatory bodies should not be indifferent between the two policies.

Fifth, the optimal choice of accounting policy does not seem sensitive to the discount rate, although in the absence of an assumed penalty for inaccuracy, higher sensitivity could be observed.

The test presented in this paper focuses on the sensitivity of the accounting choice to the change in corporate income tax rate. The main result is consistent with the implication of the model. Logit analysis of a group of 102 companies that offered both bonus and option exhibited a significant positive relationship between the choice of accounting mix (the accounting operator A) and the effective tax rate. Further, in this analysis (with R^2 as high as .7034) we confirm the results of earlier work by Watts and Zimmerman [1978], Hagerman and Zmijewski [1979], and Zmijewski and Hagerman [1981], indicating that the choice of income-increasing accounting treatments is negatively correlated with corporate size. Our model provides a theoretical rationale for this observation to the extent that sales are negatively correlated with growth (in the sense of the ratio of "true" incomes).

Although the model is highly simplified (e.g., it suppresses uncertainty and some multi-period aspects), it can be used as a framework within which examination of other variables is possible, pending the development of proper means of measurement. Included are corporation size and political costs associated with different accounting policies as a result of the exposure of the reporting firms to public and regulatory scrutiny. These variables can be formalized and included in the equation for the manager's total compensation.

APPENDIX

Distribution of Companies by Sales

Sales (in Million $)	*Number of Firms*
0–500	35
501–1000	22
1001–5000	59
5001–20000	15
20001–70000	14

Distribution of Companies by Industry

Industry	*Number of Firms*
Metals and Minerals	16
Oil, Gas, and Mining	15
Food	14
Chemicals	11
Industrial and Farm Equipment	10
Automotive	8
Paper, Fiber, and Wood	8
Communications	7
Electronics	7
Glass, Concrete, Gypsum	6
Pharmaceuticals	5
Tires and Rubber	5
Refineries	4
Textile and Vinyl	4
Office Equipment	3
Leisure	3
Consumer Parts	3
Brewing and Beverage	3
Appliances	3
Aviation	3
Heavy Equipment	2
Publishing	1
Conglomerates	1
Total	142

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A Model of Control and Audit Procedure Change in Evolving Data Processing Systems

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ABSTRACT: The data processing systems that auditors examine and evaluate are modified frequently. Somehow they must decide what effect changes to a system may have on the controls needed to ensure the system is reliable and on the audit procedures used to determine whether controls are in place and working. This paper provides a model that allows auditors to structure their search space so they can identify those system locations where controls and audit procedures must be modified when system changes occur. The model shows that auditors need examine only those parts of a system where structural changes made at the system level induce structural changes at the subsystem level. A formalism is provided for tracing the propagation of change through the various levels of subsystems.

Auditors frequently find that a data processing system they are about to examine and evaluate has changed since the last audit of the system. Consequently, they must determine the effect these system changes will have on the controls needed to maintain system reliability and on the audit procedures they use to determine whether the controls are in place and working. Unfortunately, in a system of even moderate complexity, the search space of possible control changes and audit procedure changes needed is large. A change in one component in a system potentially affects all other components. In extreme cases, auditors may conclude they cannot rely upon the prior controls implemented nor upon the audit procedures previously used to evaluate the reliability of controls.

In this paper we present a model that allows auditors to identify *where* control and audit procedure changes will be needed when a system is modified, if the reliability of the system is to be maintained and sufficient, competent evidence collection procedures are to be used. By pinpointing where control changes are needed, auditors can evaluate the adequacy of any internal control modifications already made because of changes to the system. In addition, they

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are better able to decide how to change audit procedures in response to changes to controls.

We find that auditors need examine only those subsystems where changes made to the system alter the events that can occur within the subsystem. If the events that can occur remain unchanged, auditors can disregard the subsystem during the reevaluation process. When the events that can occur do change, however, auditors must examine the subsystem to determine whether controls are in place and working to correctly designate each event as either "lawful" or "unlawful." Once any control changes needed have been identified, audit procedures can then be modified to accommodate evidence collection needs for the changed control configuration.

Analytical models have been proposed based on engineering reliability theory [Cushing, 1974; Stratton, 1981], Markov theory [Yu and Neter, 1973], and general input/output theory [Ballou and Pazer, 1985]. These models have been extended to incorporate concepts from human factors research [Bodnar, 1975] and maintainability theory [Ishikawa, 1975] and to enable optimal selection of a final set of internal controls from the set of internal controls that might be used [Hamlen, 1980]. Concerns about the tractability of these models have also motivated the development of simulation models [Burns and Loebbecke, 1975; Weber, 1978; Cooley and Cooley, 1982; Knechel, 1985; and Wiggins and Smith, 1987] and fuzzy set theoretic models [Cooley and Hicks, 1983].

Unfortunately, these models have a major limitation in terms of the objectives of the current research: namely, they fail to provide a way to pinpoint *where* control and audit procedure changes will be needed when a system is modified. They assume that the location of and set of control and audit procedure changes required have been determined. They focus instead on assessing the comparative reliability of alternative control configurations for the modified system.

The tractability of this reevaluation process is a serious concern, however. Bailey et al. [1981] have shown that an evaluation of the reliability of internal controls in many systems is a nondeterministic polynomial (NP) complete problem. In other words, a feasible solution might not be found by expending computing resources that are polynomially bound by some measure of the size of the system. Thus, it is essential to have strategies to reduce the size of this reevaluation problem in order to find tractable solutions [Bailey et al., 1985]. One approach is to try to develop an expert system incorporating the heuristics expert auditors use when they confront the reevaluation problem [Bailey et al., 1987]. Another approach is to develop models for reducing the size of the problem.

In this paper we adopt the latter approach. We provide a precise protocol for decomposing the reevaluation problem into smaller problems so that the analytical and simulation models described above can be applied more effectively. Our model extends the prior research by providing a mechanism for identifying those parts of a system that need reevaluation. It facilitates the practical application of any analytical and simulation models developed to assess internal control reliability.

Our model formalizes and extends a qualitative model developed by Davis and Weber [1986] to predict the effects of system change on controls and audit procedures. We rely primarily on ontological concepts developed by Bunge [1977, 1979], although we have modified and extended his model in several ways (see, also, Mattesich [1982]).

The model development proceeds through three phases. First (Section I), we adapt the system definitions proposed by Bunge [1977] to the accounting information systems domain. Second (Section II), within this framework, we define the concepts of control and audit procedure. Third (Section III), we introduce concepts that describe how changes permeate a system. In particular, we provide rules to identify those parts of a system which may require changes to controls and audit procedures as a result of a structural change. Section IV discusses some implications of the model and Section V presents conclusions.

I. SYSTEM DEFINITIONS AND NOTATIONS FOR THE MODEL

The elementary concept in our formalism is a *thing*.[1] We begin by defining the *state of a thing*. In the context of a particular model of a thing, a state of a thing is represented by the values of the properties or attributes of the thing. Thus, we have:[2]

> *Definition 1**: Let X be a thing modeled by a functional schema $X_M = \langle M, \tilde{F} \rangle$, and let each component of the function
>
> $$\tilde{F} = \langle F_1, \ldots, F_n \rangle : M \rightarrow V_1 \otimes \ldots \otimes V_n$$
>
> represent a *property* of X. Then F_i, $1 \leq i \leq n$, is called the *ith state function* of X, $\tilde{F}$ is called the *total state function* of X, and $S(X) = \{\langle x_1, \ldots, x_n \rangle \in V_1 \otimes \ldots \otimes V_n \mid x_i = F_i(M)\}$ is called the *possible state space* of X. Note, M is a specific model of the thing.

To illustrate, we will use a single example throughout the remainder of the paper. Assume, for the moment, that a data processing system is a thing, and consider the simple company payroll system shown in Figure 1. The company using this system has only two job types: office jobs and sales jobs. In each job type, an employee may be in a regular position or a managerial position. The system takes as inputs the following data items: an end-of-period indicator, employee type, position, base pay rate, total hours worked in the pay period, and total sales made by an employee in the pay period. The system produces as outputs the following data items: base pay, overtime pay, commission, benefits, and total compensation.

Table 1 shows a state description of the system (thing). A state of the system is described by the vector:

> (End,EmpT,EmpP,PayR,Hours,
> Sales,Base,Over,Com,Ben,Total).

The possible state space of the system would be represented by the set of all combinations of state variable values that the vector might assume. Note, Table 1 shows only one possible state description of the system. For example, we have not used state functions to describe program instructions used in the system nor relations among data items. In addition, we have ignored the values for "regular hours" used to calculate base pay and "percentage" used to calculate the employer's pension contribution. In this respect we have chosen a particular *functional schema* (in the interests of simplicity) to describe the thing in order to reflect our particular purposes in modeling the thing.

Not all states of a thing are lawful. The values of the attributes of a thing may be restricted by various rules. These rules define the *lawful state space* of a

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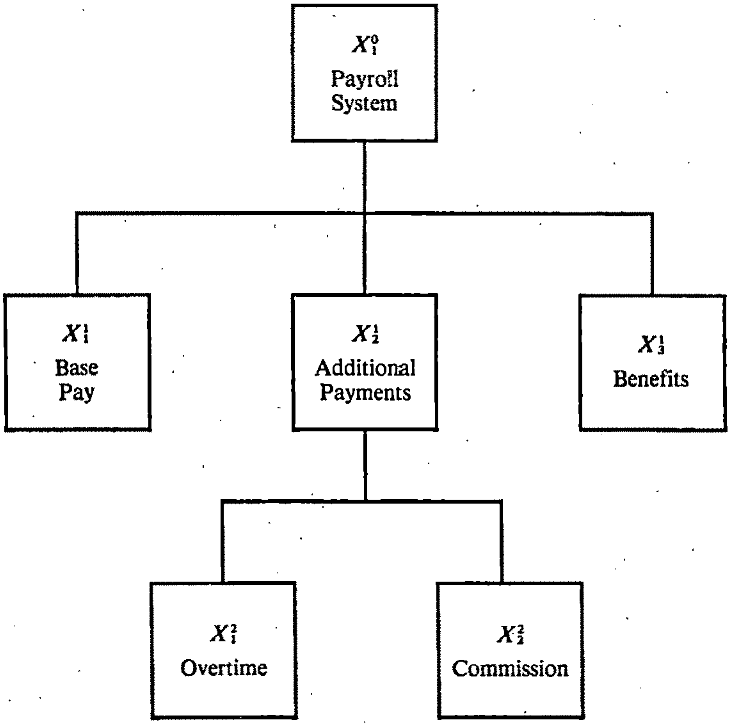
[1] We start with the general notion of a "thing" because, in due course, we define the notion of a "system" precisely. However, readers can assume that systems are things if they are distracted by the term "thing."

[2] Definitions taken from or adapted from Bunge [1977, 1979] are starred—"*."

FIGURE 1
EXAMPLE PAYROLL SYSTEM



thing. We first define the notion of a *law statement*:

*Definition 2**: Let $X_M = <M,\widetilde{F}>$ be a functional schema for a thing X. Any restrictions on the possible values of the components of $\widetilde{F}$ and any relation among two or more such components is called a *law statement*, $l(X) \in L(X)$. Thus, $L(X): V_1 \otimes \ldots \otimes V_n \rightarrow$ {unlawful, lawful}.

Law statements reflect constraints imposed upon the thing, by nature, or by the users of the thing. In the context of an information system, they reflect the semantics of the application domain. For example, in the payroll system, the value of hours worked (Hours) may have to be a nonnegative integer that is less than 61 (a restriction rule). In addition, managers may not be entitled to overtime pay (a relational rule). Accordingly, only a subset of the possible state space of a thing may be deemed lawful:

*Definition 3**: Let $X_M = <M,\widetilde{F}>$ be a functional schema for a thing X, where $\widetilde{F}: <F_1, \ldots, F_n>: M \rightarrow V_1 \otimes \ldots \otimes V_n$ is the state function, and let $L(X)$ be the set of all law statements on X. Then the subset of the codomain V restricted under $L(X)$ is called the *lawful state space* of X in the representation X_M. That is, $S_L(X) = \{<x_1, \ldots, x_n> \in V_1 \otimes \ldots \otimes V_n \mid \widetilde{F}$ satisfies every $l(X) \in L(X)\}$.

Now consider the concepts of event, lawful transformation, lawful event, and

TABLE 1
STATE DESCRIPTION OF THE PAYROLL SYSTEM

Property	*State Function*	*Description*
End-of-Period	End	An indicator to signal the end of the pay period. When the end of the pay period is reached, the indicator is changed from "0" to "1" and the pay is calculated.
Employee Type	EmpT	Office (*o*) or sales (*s*).
Position	EmpP	Regular (*r*) or management (*m*).
Pay Rate	PayR	The regular pay per hour.
Hours Worked	Hours	Hours reported for pay period.
Sales Value	Sales	Value of sales made by an employee for the pay period.
Base Pay	Base	The base pay for an employee is calculated by multiplying the pay rate by a fixed number of regular hours.
Overtime Pay	Over	Overtime pay is the product of the pay rate multiplied by a certain factor (greater than one) and the difference between hours worked and regular hours.
Commission	Com	Calculated based on sales value.
Benefits	Ben	Employer's pension plan contribution as a fixed percentage of base pay.
Total Compensation	Total	Sum of the base pay, overtime pay, commission, and benefits.

lawful event space. The behavior of a thing (system) is manifested through the events that occur in the thing (system). An *event* can be described via a transition between two states: a "before" state (or head) and an "after" state (or tail):

> *Definition 4**: An ordered pair $<s,s'>$, where $s,s' \in S(X)$ will be called an *event.*

However, not all transitions between the states of a thing are lawful, and so not all events are lawful. Hence, we have:

> *Definition 5**: Let $S_L(X)$ be the lawful state space of a thing X. We denote by $G_L(X)$ the set of transformations from the state space into itself that are given as lawful in the system. That is, $G_L(X) \subseteq S_L(X) \otimes S_L(X)$.

> *Definition 6**: Let $S_L(X)$ be the lawful state space of a thing X, and let $G_L(X)$ be the set of lawful transformations on the state space into itself. Then a *lawful event* in X is represented by the ordered pair $<s,s'>$ where $s,s' \in S_L(X)$ and $s' = g(s), g \in G_L(X)$.

> *Corollary 6*: The *lawful event space* of a thing X is the set of ordered pairs: $E_L(X) = \{<s,s'> \mid s,s' \in S_L(X) \wedge s' = g(s) \wedge g \in G_L(X)\}$.

To illustrate these concepts, consider again the payroll system example. Assume that company policy is as follows:

(a) Office staff are entitled to overtime pay but not to commissions.
(b) Sales staff are entitled to commissions but not to overtime pay.
(c) Managers are entitled to neither

TABLE 2

SUBSET OF POSSIBLE EVENT SPACE FOR PAYROLL SYSTEM

Lawful Event Types:

e_1: <(0,*o*,*r*,PayR,Hours,Sales,0,0,0,0,0),
(1,*o*,*r*,PayR,Hours,Sales,Base,Over,0,Ben,Total)>

e_2: <(0,*s*,*r*,PayR,Hours,Sales,0,0,0,0,0),
(1,*s*,*r*,PayR,Hours,Sales,Base,0,Com,Ben,Total)>

e_3: <(0,*o*,*m*,PayR,Hours,Sales,0,0,0,0,0),
(1,*o*,*m*,PayR,Hours,Sales,Base,0,0,Ben,Total)>

e_4: <(0,*s*,*m*,PayR,Hours,Sales,0,0,0,0,0),
(1,*s*,*m*,PayR,Hours,Sales,Base,0,0,Ben,Total)>

Unlawful Event Types:

e_5: <(0,*s*,*m*,PayR,Hours,Sales,0,0,0,0,0),
(1,*s*,*m*,PayR,Hours,Sales,Base,Over,Com,Ben,Total)>

e_6: <(0,*s*,*m*,PayR,Hours,Sales,0,0,0,0,0),
(1,*s*,*m*,PayR,Hours,Sales,Base,0,Com,Ben,Total)>

e_7: <(0,*s*,*r*,PayR,Hours,Sales,0,0,0,0,0),
(1,*p*,*r*,PayR,Hours,Sales,Base,0,0,Ben,Total)>

overtime pay nor commissions.

(d) Hours and sales are recorded for all employees because even managers must report hours, and office employees might take a phoned-in order.

Table 2 shows four generic event *types* that are lawful under these policies. To understand the meaning of these event types, consider an event of (generic) type e_1. The state of the system before the event reflects the various payroll details reported for the employees during the pay period. These details may change during the period; however, to simplify matters, updating the employee data is not considered to be a part of the system we analyze. At the end of the pay period, the end-of-period indicator is changed. The various payment components are then calculated. As a result, the system ends up in a new state. Later, the employee record must be reset to a "during-the-pay-period" state. This event is not included in our analysis because we have excluded updating considerations.

Note that Table 2 also contains examples of some unlawful event types. Event types e_5 and e_6 contravene the company policy described above. Event type e_7 shows an unlawful change of employee type from "*s*" to "*p*." This event is unlawful because "*p*" is not a valid employee type.

Consider, now, the dynamics of a thing. We are interested in formalizing the *history* of a thing and how two things are *bonded* or *coupled* together. As time changes, the state of a thing may change and the evolution of the states of a thing may be viewed as its history. The concept of history is used to describe the interaction between things. A thing acts on another thing if the history of the latter depends upon the history of the former. Two things are coupled if at least one of the things acts on the other. More precisely, we have:

> *Definition 7**: Let $\widetilde{F}$ be the state function of a thing X, let t be a time instant ($t>0$). Then a *history* of X is the set of ordered pairs, $h(X)=\{<t,\widetilde{F}(X,t)>\}$.
>
> *Definition 8**: A thing X *acts on* a thing Y, denoted $X \rhd Y$, iff $h(Y|X) \neq h(Y)$.
>
> *Definition 9**: Two things X and Y are *coupled*, denoted $B(X,Y)$ if $(X \rhd Y) \vee (Y \rhd X)$.

Figure 2 is a graphical representation of the payroll system. The vertices in the graph represent the things in the system and the arcs represent the bondings among the things. The bondings' nature can be found from the state description of the payroll system in Table 1. However, by way of illustration, consider the things PayR, End, and Base. The history of Base is dependent upon the history of PayR because the value of Base is calculated as a function of the value of PayR. Thus, Base and PayR are bonded. Similarly, Base and End are coupled because Base is calculated when the value of End changes.

It is now possible to define precisely the concept of a *system*. A system is a set of things where each thing in the set is coupled with at least one other thing in the set.[3] In addition, it must be possible to follow the route between any two things in the set via couplings. Formally, we have:

> *Definition 10*: Let $C \subseteq \theta$, where θ is the set of all things, and let B_C be the set of couplings among the elements of C. Let $\sigma(C,B_C)$ be a graph, where C is the set of vertices and B_C is the set of edges. Then $\sigma(C,B_C)$ is a *system* iff it is a connected graph. Henceforth, $\sigma(C,B_C)$ will be denoted by σ.

This definition of a system has two important implications. First, each thing in a system must be connected to at least one other thing. Second, an "overall" connection must exist among the things in the system. Figure 2 shows that the payroll system (X_1^0) is a system.

Unfortunately, it is not easy to define the concept of a subsystem. We must first define a minimal model of a system at a point in time [Bunge, 1979, p. 8]. We begin by defining a *class of things* as a set of things that possess a common property:

> *Definition 11**: Let $p(X)$ denote that a thing x has a particular property, and let $X \subset \theta$, then X is a *class* of things iff $(\forall x \in X)(p(x))$.

Clearly, classes of things may be defined over many properties of things. In the context of a data processing system, however, classes are used primarily to accomplish two purposes. First, a class designates things at a particular *level of abstraction*. In the payroll system example, the class of things is data objects. We do not focus, for instance, on the bit patterns used to store the values of these data objects in a machine. Second, a class *restricts the environment* of the system. For example, we ignore certain personal characteristics of the employee such as gender or age because they are not relevant for our purposes.

Having identified a class of things, we can define the composition, environment, and structure of a system defined over things in the class. The things that make up the system represent the *composition* of the system. Those things outside the system that are bonded to things in the system are the *environment* of the system. The *structure* of the system com-

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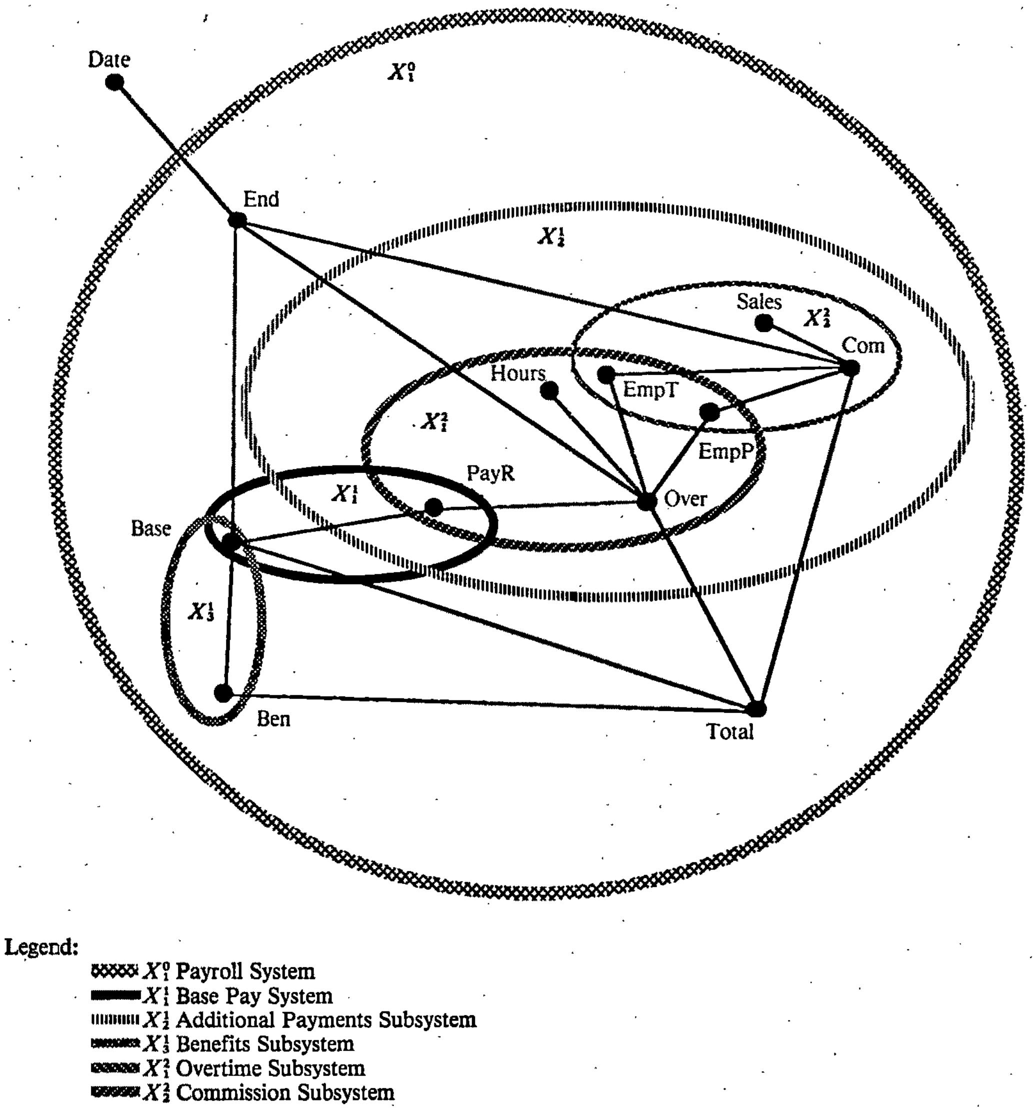
[3] The boundary of a system is in the eyes of the beholder and is specified via the things that are included in or excluded from the set.

FIGURE 2
GRAPHICAL REPRESENTATION OF PAYROLL SYSTEM



prises (a) the internal bondings among things in the system, and (b) the external bondings among things in the system and things in the environment. More precisely, we have:

*Definition 12**: Let $A \subset \theta$ be a class of things, and let σ be a system, then:

(a) the *A-composition* of σ at time t is the set of its A-parts at t:

$$\tilde{C}_A(\sigma,t)=\{x\in A \mid x \text{ is a part of } \sigma\},$$

(b) the *A-environment* of σ at time t is the set of all things of kind A, not components of σ, that act on or are acted upon by components of σ at time t:

$$\widetilde{E}_A(\sigma,t)=\{x\in A\,|\,(x\notin\widetilde{C}_A(\sigma,t) \wedge(\exists y)(y\in\widetilde{C}_A(\sigma,t) \wedge B(x,y))\},$$

(c) the *A-structure* of σ at time t is the set of couplings among the components of σ and among them and the set of components in the environment of σ:

$$\widetilde{S}_A(\sigma,t)=\{R_i\in\bar{B}_A(\sigma,t)\cup\hat{B}_A(\sigma,t)\,|\,\bar{B}_A\neq\emptyset\wedge\hat{B}_A\neq\emptyset\},$$

where

$$\bar{B}_A(\sigma,t)=\{B_A(x,y)\,|\,x,y\in\widetilde{C}_A(\sigma,t)\},\text{ and}$$

$$\hat{B}_A(\sigma,t)=\{B_A(x,y)\,|\,(x\in\widetilde{C}_A(\sigma,t) \wedge y\in\widetilde{E}_A(\sigma,t)) \vee(x\in\widetilde{E}_A(\sigma,t) \wedge y\in\widetilde{C}_A(\sigma,t))\}.$$

To illustrate these notions, consider the benefits system shown in Figure 2. Its composition, $\widetilde{C}_A$, has two members: Base and Ben. They are elements of the class A and parts of (substantively, not conceptually) the benefits system. The environment, $\widetilde{E}_A$, of the benefits system has three elements: End, Total, and PayR. Base is bonded to End because, when the value of End changes, the value of Base is calculated. Base and Ben are bonded to Total because the value of Total is a function of the values of Base and Ben. Base is bonded to PayR because the value of Base is a function of the value of PayR. Finally, $\widetilde{S}_A$, the structure of the benefits system comprises the internal bonding, $\bar{B}_A$, between Base and Ben, and the external bondings, $\hat{B}_A$, between Base and End, Base and PayR, Base and Total, and Ben and Total.

A minimal model of a system, therefore, comprises the set $\{\widetilde{C}_A,\widetilde{E}_A,\widetilde{S}_A\}$. In this light we can now define the concept of a *subsystem* as a system with a composition and a structure which are subsets of another system, and with an environment which is a subset of those components that are in the environment of the system plus those components that are in the system but not in the subsystem. More formally, we have:

*Definition 13**: Let σ be a system with composition $\widetilde{C}(\sigma,t)$, environment $\widetilde{E}(\sigma,t)$, and structure $\widetilde{S}(\sigma,t)$ at time t. Then x is a subsystem of σ, denoted $x<\sigma$, iff:

(a) x is a system at time t, and
(b) $(\widetilde{C}(x,t)\subseteq\widetilde{C}(\sigma,t))\wedge(\widetilde{E}(x,t) \subseteq(\widetilde{E}(\sigma,t)\cup(\widetilde{C}(\sigma,t) -\widetilde{C}(x,t)))\wedge(\widetilde{S}(x,t) \subseteq\widetilde{S}(\sigma,t))$.

Notation 13: If x is a subsystem of σ, then σ is a *supersystem* of x.

Figure 2 shows that the benefits system is a subsystem of the payroll system. Its composition, $\widetilde{C}(x)=\{\text{Base},\text{Ben}\}$, is a subset of the composition of the payroll system. Its structure, $\widetilde{S}(x)$, comprising the internal bonding $\bar{B}_A=\{(\text{Base},\text{Ben})\}$ and the external bondings $\hat{B}_A=\{(\text{Base},\text{End}),(\text{Base},\text{PayR}),(\text{Base},\text{Total}),(\text{Ben},\text{Total})\}$ is a subset of the structure of the payroll system. Its environment, $\widetilde{E}(x)=\{\text{End},\text{PayR},\text{Total}\}$, is a subset of the environment of the system plus those components that are in the system but not in the subsystem. Likewise, it is apparent that the overtime system and commission system are subsystems of the additional payments system and payroll system and that the base pay system and additional payments system are also subsystems of the payroll system.

II. CONTROL AND AUDIT PROCEDURE DEFINITION AND NOTATION

In this section we provide precise definitions of both the concept of a control that is in place and working, and the concept of an audit procedure. Both concepts are rooted in the notions of event, lawful event, lawful event space, and system, analyzed in the previous section.

A *control* is defined as a system that determines whether the states and events in another system are unlawful or lawful. A control system's transfer function is an indicator function that maps the set (or a subset) of possible events in the system it monitors into the values $\{0,1\}$ (unlawful$=0$ and lawful$=1$). Thus:

> *Definition 14*: Let $E_K \subseteq E(\sigma)$. A *control K* over a system σ is a system with a transfer function $f_K: E_K \rightarrow \{0,1\}$. E_K will be termed the set of events *covered* by the control K.

> *Notation 14*: A control is a *covering* iff $E_K = E(\sigma)$.

> *Corollary 14*: A *covering control* for a system can always be built.

We have ascribed two major properties to controls. First, they are systems; thus, they have all the properties of a system described above. Second, controls designate each event in their domain as either lawful or unlawful. However, auditors need to know whether controls are in place and working. If every event in the possible event space of the system is covered by at least one control, we say a control is in place with respect to each event, or:

> *Definition 15*: Let $K(\sigma)$ be a set of controls over σ. A control is *in place* iff $\forall (<s,s'> \in E(\sigma)), (\exists K, K \in K(\sigma))$: $f_K(<s,s'>) \in \{0,1\}$.

In addition, a control is working when it correctly assigns the value "1" to events in its domain if, and only if, the events are within the lawful event space of the system and the value "0" to events in its domain if, and only if, the events are not within the lawful event space of the system, or:

> *Definition 16*: Let $E_K \subseteq E(\sigma)$. A control K over a system σ is *working* iff $\forall (<s,s'> \in E_K), f_K(<s,s'>) = 1$ iff $<s,s'> \in E_L(\sigma)$.

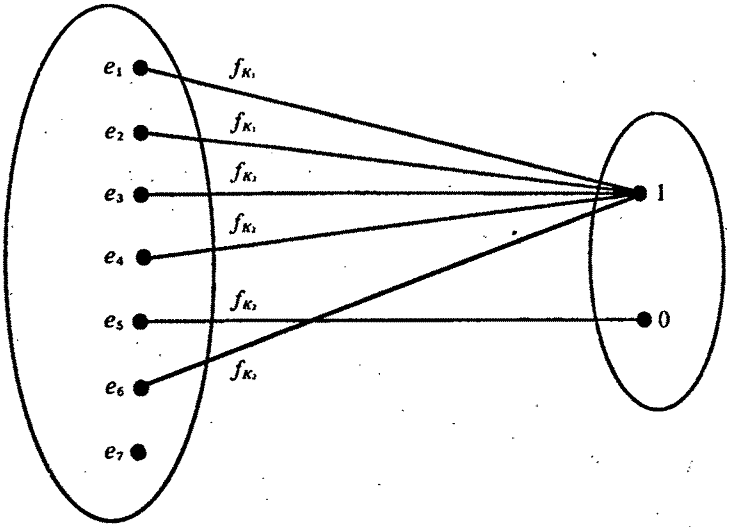
To illustrate these concepts, Table 2 shows a subset of the possible event space for the payroll system example. Assume there are two controls over the system: control K_1, which is supposed to check that only regular office employees can earn overtime and only regular sales employees can earn commission; and control K_2, which is supposed to check that managers can earn neither overtime nor commission.

Figure 3 shows a mapping between the event types given in Table 2 and the set $\{0,1\}$. K_1 correctly designates event types e_1 and e_2 as lawful. K_2 correctly designates event types e_3 and e_4 as lawful and event type e_5 as unlawful. However, K_2 wrongly designates event type e_6 as lawful, so control K_2 has somehow been wrongly implemented. For example, it may incorrectly designate an event relating to managers as unlawful only when *both* overtime and commission are nonzero. Instead, it should designate the event as unlawful if *either* overtime or commission are unlawful. Thus, control K_1 is working but control K_2 is not working.

Note, also, from Table 2 and Figure 3 that no control exists to designate event type e_7 as unlawful. Event type e_7 relates to an employee type "*p*," which is not a lawful employee type. Since no control covers the event type, a control is not in place.

Finally, an audit procedure is a system used to determine whether controls are in place and working. If a control is in

FIGURE 3
CONTROL MAPPINGS



e_i=Event type i
f_{K_j}=Transfer function for control K_j
0=Unlawful event
1=Lawful event

place and working for an event, an audit procedure maps the event into the value "1" (lawful). If, however, either a control is not in place for the event or one of the controls that covers the event is not working, an audit procedure maps the event into the value "0" (unlawful).[4] Thus, we have:

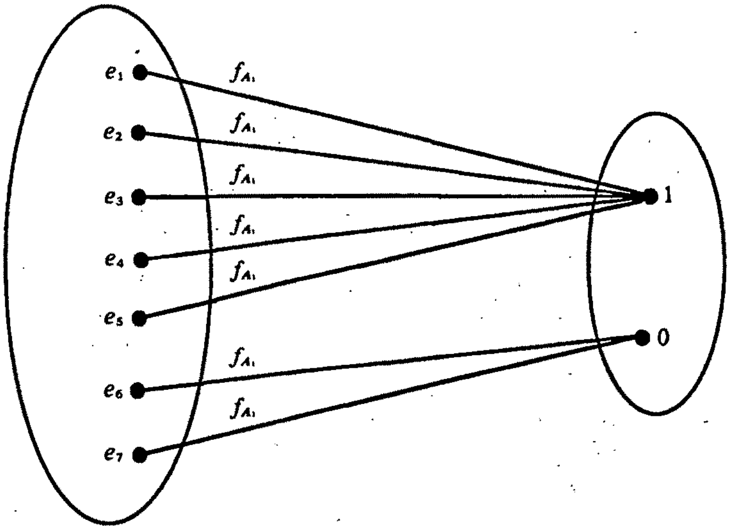
> *Definition 17*: Let $K(\sigma)$ be a set of controls over σ, and let $\alpha=\{0,1\}$. An *audit procedure* is a system with a transfer function f_A such that $\forall$ ($<s, s'>$):
>
> $$\begin{aligned} f_A(<s,s'>) &= 0 \text{ if } \forall K, K \in K(\sigma): \\ &\quad (<s,s'>,\alpha) \notin f_K. \\ &= 0 \text{ if } \exists K, K \in K(\sigma): \\ &\quad ((<s,s'>,\alpha) \in f_K) \\ &\quad \wedge (f_K(<s,s'>)=0 \\ &\quad \text{if } <s,s'> \in E_L(\sigma) \\ &\quad \vee f_K(<s,s'>)=1 \\ &\quad \text{if } <s,s'> \notin E_L(\sigma)). \\ &= 1 \text{ if } \forall K, K \in K(\sigma) \\ &\quad |((<s,s'>,\alpha) \in f_K): \\ &\quad (f_K(<s,s'>)=0 \\ &\quad \text{if } <s,s'> \notin E_L(\sigma) \\ &\quad \wedge f_K(<s,s'>)=1 \\ &\quad \text{if } <s,s'> \in E_L(\sigma)). \end{aligned}$$

To illustrate, assume that a single audit procedure A_1 is used to determine whether controls for the seven event types shown are in place and working. Figure 4 shows the mapping for the seven event types in the presence of controls K_1 and K_2. Event types e_6 and e_7 are the only events mapped to the value "0"—the former because control K_2 is not working for that event type, and the lat-

---

[4] Note the distinction between a control and an audit procedure. If a control covers an event, it maps the event to the value "1" if it deems the event to be lawful and to the value "0" if it deems the event to be unlawful. An audit procedure maps the event to the value "1" (lawful) only if a working control covers the event. Otherwise, it maps the event to the value "0" (unlawful).

Figure 4
Audit Procedure Mapping



e_i=Event type i
f_{A_1}=Transfer function for audit procedure A_1 given controls K_1 and K_2
0=Control not in place *or* not working
1=Control in place and working

ter because no control is in place to cover it. The remaining event types are mapped to the value "1" because at least one control is in place to cover the event type and all those controls that cover the event type are working.

III. Equilibrium and Change

Our model's purpose is to determine when control and audit procedure changes will be needed and the locus of the changes. First, we identify when control and audit procedure changes will *not* be needed—a controls equilibrium—and then how this equilibrium can be disrupted.

Intuitively, a (local) controls equilibrium exists when a control is in place and working for every event in a subset of the system's event space. For the subset of states and transformations, a controls equilibrium exists if a control is in place and working for each event that can be produced (i.e., any instance of the event types shown in Table 2). More precisely, we have:

> *Definition 18*: Let σ be a system, let $S'(\sigma) \subseteq S(\sigma)$ be a subset of the state space of the system, and let $G'(\sigma) \subseteq G(\sigma)$ be a subset of the transformations on the state space $S(\sigma)$. Then, σ is in a controls equilibrium in the region $S'(\sigma)$ with respect to the subset of transformations $G'(\sigma)$ iff $(\forall s \in S'(\sigma))$, $(\forall g \in G'(\sigma))$, $s' = g(s)$, $s' \in S'(\sigma)$, and $\forall <s,s'> \in S'(\sigma)$ a control is in place and working.

Thus, in practice evaluation of whether a system is in a controls equilibrium, usually focuses on a conditional event space, $E(\sigma|S',G')$, and a conditional lawful event space, $E_L(\sigma|S',G')$. The conditional event space is specified by selecting a subset of the state space, S', and a subset of transformations, G', for a partial rather than a complete evaluation.

Consider, now, a transformation, $g \notin G'$, undertaken to implement a *structural* alteration to the system. For example, assume the system is modified to reflect the following change of company policy:

(a) Both office staff and salespersons will now be entitled to overtime and commissions.
(b) However, an office employee cannot obtain more money in commissions than in overtime, and a salesperson cannot obtain more in overtime than in commissions.

Since the state space of a system can include all states of a thing *from the beginning to the end of its life*, the new state of the system that reflects this altered company policy may still be a lawful state. Moreover, the (modification) event that brings about this new state may also be a lawful event. Clearly, however, the set of events that can now occur and be considered lawful is different from the set of events that could occur lawfully prior to the structural modification event. In particular, this change in the set of events that can be considered lawful by virtue of the new state that the system has assumed may evoke a change in controls. As a consequence of this modification event, a new subset of the state space, $S'' \subseteq S$, and a new subset of transformations, $G'' \subseteq G$ are relevant. The auditor seeks to evaluate whether a controls equilibrium exists for the event space defined via S'' and G''.

How does a change in the conditional lawful event space of the system propagate through the system to affect the conditional lawful event space of each subsystem of the system? Intuitively, if a change in the conditional lawful event space of the system leaves the conditional lawful event space of a subsystem unchanged, there will be no need to change the controls over that subsystem. However, if a change in the conditional lawful event space of the system does change the conditional lawful event space of a subsystem, it may be necessary to change controls over that subsystem.

Understanding how change propagates through a system has five requirements. First, we must be able to *decompose* a system into its subsystems. Second, to understand how change at the system level affects the subsystems in the decomposition requires the concept of a *state space of a decomposition* of a system. Third, the state space of the system must be *mapped* into the state space of the decomposition of the system. Fourth, is the notion of an *induced event* —an event at the system level that evokes an event at the subsystem level. Fifth, we then need to show how induced events in subsystems propagate further to their own subsystems. Accordingly, we introduce the notion of a *level structure* over a system.

We define, first, the concept of a decomposition over a system as a set of subsystems of the system where (a) every element in the composition of the system is included in at least one of the subsystems in the set, (b) the set difference between the union of the environments of the subsystems and the composition of the system equals the environment of the system, and (c) each element in the structure of the system is included in at least one of the subsystems in the set. More precisely:

Definition 19: Let I be an index set and let $D(\sigma)=\{x_i\}_{i\in I}$ where $x_i<\sigma$. Then $D(\sigma)$ is a *decomposition* over σ iff:

(a) $\widetilde{C}(\sigma)=\cup_{i\in I}\widetilde{C}(x_i)$,
(b) $\widetilde{E}(\sigma)=\cup_{i\in I}\widetilde{E}(x_i)-\widetilde{C}(\sigma)$, and
(c) $\widetilde{S}(\sigma)=\cup_{i\in I}\widetilde{S}(x_i)$.

Table 3 shows that the set of subsystems comprising the payroll subsystem, the base pay subsystem, the additional payments subsystem, the benefits subsystem, the overtime subsystem, and the commission subsystem have the properties of a decomposition. They are a decomposition of the payroll system.[5]

Note, the definition of a decomposition recognizes that a system may be broken up into subsystems in alternative ways. Figures 1 and 2 show a decomposition of the payroll system—it is not the only one. Indeed, the choice of an "optimal" decomposition is a problem of fundamental importance [Courtois, 1985]. In this paper, we assume the system decomposition is given.

Since the ultimate interest is whether changes in the event space of a system induce changes in the event space of a subsystem, we show the relation between the system's state space and the state space of a decomposition of the system. First, we define the concept of the state space of a decomposition of the system:

Definition 20: Let I be an index set and $D(\sigma)$ be a decomposition over a system σ. Then the *possible state space* of the decomposition is the Cartesian product of the possible state spaces of the subsystems that constitute the decomposition. That is, $S(D(\sigma))=\otimes_{i\in I}S(x_i)$.

Notation 20a: Henceforth, $S(D(\sigma))$ will be abbreviated to $S(D)$.

To illustrate this concept, consider, again, the payroll system example. To simplify matters, assume for the moment that the payroll system is decomposed into only two subsystems: base pay, x_1, and additional payments, x_2; that is, $D(\sigma)=\{x_1,x_2\}$.[6] Assume, also, that for each (sub)system we use only one state variable to describe its state: Total for the payroll system; Base for the base pay subsystem; and AddP for the additional payments subsystem. If the base pay system can take on only two states (dollar values): $S(x_1)=\{s_1^1,s_1^2\}=\{100,400\}$, and the additional payments subsystem can take on only three states (dollar values): $S(x_2)=\{s_2^1,s_2^2,s_2^3\}=\{0,100,200\}$, then the possible state space of the decomposition is:

$$\begin{aligned}S(D)=&\{(s_1^1,s_2^1),(s_1^1,s_2^2),(s_1^1,s_2^3),(s_1^2,s_2^1),\\&(s_1^2,s_2^2),(s_1^2,s_2^3)\},\\=&\{(100,0),(100,100),(100,200),\\&(400,0),(400,100),(400,200)\}.\end{aligned}$$

Since the system's state is a simple algebraic function of the two subsystem's states, the state space of the system can assume six dollar values: $S(\sigma)=\{s_1,\ldots,s_6\}=\{100,200,300,400,500,600\}$.

More generally, even though the possible state space of the system is not *equal to* the possible state space of a decomposition of the system, we can always *map* the possible state space of the system into the possible state space of a system's decomposition of the system. Accordingly, we have:

Lemma 1: Let $S(\sigma)$ be the possible state space of a system σ, let $S(D)$ be the possible state space of a decompo-

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[5] Note that the payroll system itself must be included as a subsystem of the decomposition because the things End and Total are not components in any other subsystem. These two things manifest *emergent properties* of the system [Bunge, 1979, pp. 27–30].

[6] Without loss of generality, to avoid complex state representations and complex subscripting in the simplified example, the base pay subsystem, x_1, is X_1^1 in Figure 1. The additional payments system, x_2, is X_2^1 in Figure 1. No further decomposition has been undertaken.

TABLE 3

DECOMPOSITION CHARACTERISTICS OF PAYROLL SYSTEM SUBSYSTEMS

(a) Composition

$\tilde{C}(x_1^0)$ = {End,Total,EmpT,EmpP,Sales,Com,Hours,Over,PayR,Base,Ben}
$\tilde{C}(x_1^1)$ = {Base,Ben}
$\tilde{C}(x_2^1)$ = {EmpT,EmpP,Sales,Com,Hours,Over,PayR}
$\tilde{C}(x_3^1)$ = {Base,Ben}
$\tilde{C}(x_1^2)$ = {EmpT,EmpP,Hours,PayR,Over}
$\tilde{C}(x_2^2)$ = {EmpT,EmpP,Sales,Com}

Thus, $\bigcup_{x_j^i \in D(\sigma)} \tilde{C}(x_j^i)$

= {End,Total,EmpT,EmpP,Sales,Com,Hours,Over,PayR,Base,Ben}
= $\tilde{C}(\sigma)$

(b) Environment

$\tilde{E}(x_1^0)$ = {Date}
$\tilde{E}(x_1^1)$ = {End,Ben,Total,Over}
$\tilde{E}(x_2^1)$ = {End,Base,Total}
$\tilde{E}(x_3^1)$ = {End,PayR,Total}
$\tilde{E}(x_1^2)$ = {End,Base,Com,Total}
$\tilde{E}(x_2^2)$ = {End,Over,Total}

Thus, $\bigcup_{x \in D(\sigma)} \tilde{E}(x) - \tilde{C}(\sigma)$

= {Date,End,Ben,Total,Over,Base,PayR,Com} $- \tilde{C}(\sigma)$
= {Date}
= $\tilde{E}(\sigma)$

(c) Structure

$\tilde{S}(x_1^0)$ = {(Date,End,),(End,Com),(End,Base),(End,Over),(Sales,Com),
(EmpT,Com),(EmpP,Com),(Hours,Over),(EmpT,Over),
(EmpP,Over),(Base,PayR),(PayR,Over),(Over,Total),
(Total,Com),(Base,Total),(Ben,Total),(Base,Ben)}
$\tilde{S}(x_1^1)$ = {(Base,PayR),(Base,End),(Base,Ben),(Base,Total),
(PayR,Over)}
$\tilde{S}(x_2^1)$ = {(End,Com),(End,Over),(Base,PayR),(Over,Total),
(Total,Com),(Sales,Com),(EmpT,Com),(EmpP,Com),
(EmpT,Over),(EmpP,Over),(Hours,Over),(PayR,Over)}
$\tilde{S}(x_3^1)$ = {(Base,Ben),(End,Base),(Base,PayR),(Base,Total),
(Ben,Total)}
$\tilde{S}(x_1^2)$ = {(End,Over),(Base,PayR),(Over,Total),(EmpT,Com),
(EmpP,Com),(PayR,Over),(Hours,Over),(EmpT,Over),
(EmpP,Over)}
$\tilde{S}(x_2^2)$ = {(End,Com),(EmpT,Over),(EmpP,Over),(Total,Com),
(Sales,Com),(EmpT,Com),(EmpP,Com)}

Thus, $\bigcup_{x \in D(\sigma)} \tilde{S}(x)$

= {(Date,End),(End,Com),(End,Base),(End,Over),
(Sales,Com),(EmpT,Com),(EmpP,Com),(Hours,Over),
(EmpT,Over),(EmpP,Over),(Base,PayR),(PayR,Over),
(Over,Total),(Total,Com),(Base,Total),(Ben,Total),
(Base,Ben)}
= $\tilde{S}(\sigma)$

> sition over σ, and let $2^{S(D)}$ be the power set of $S(D)$. Then a function, H, exists that maps the possible state space of the system into the power set of the possible state space of a decomposition of the system. That is, $H:S(\sigma)\rightarrow 2^{S(D)}$.
>
> *Notation 20b*: Let $s\in S(\sigma)$. Denote by $d(s)\in 2^{S(D)}$ the set of all corresponding states in $S(D)$, $H(s)=d(s)$. However, henceforth we will assume (unless otherwise noted), without loss of generality, that $|d(s)|=1$, and we will use $d(s)$ to denote this element.[7]
>
> *Notation 20c*: Let $d_i(s)$ be the ith component of $d(s)$; namely, the state of the ith subsystem when the system is in state $s\in S(\sigma)$.

In the context of our payroll system example, therefore, the following mapping applies:

$$\begin{aligned}
H(s_1)=d(s_1)&=\{(s_1^1,s_2^1)\}\text{, i.e., }H(100)\\
&=\{100,0\}\text{ and }d_1(s_1)\\
&=100,\ d_2(s_1)=0.\\
H(s_2)=d(s_2)&=\{(s_1^1,s_2^2)\}\text{, i.e., }H(200)\\
&=\{100,100\}\text{ and }d_1(s_2)\\
&=100,\ d_2(s_2)=100.\\
H(s_3)=d(s_3)&=\{(s_1^1,s_2^3)\}\text{, i.e., }H(300)\\
&=\{100,200\}\text{ and }d_1(s_3)\\
&=100,\ d_2(s_3)=200.\\
H(s_4)=d(s_4)&=\{(s_1^2,s_2^1)\}\text{, i.e., }H(400)\\
&=\{400,0\}\text{ and }d_1(s_4)\\
&=400,\ d_2(s_4)=0.\\
H(s_5)=d(s_5)&=\{(s_1^2,s_2^2)\}\text{, i.e., }H(500)\\
&=\{400,100\}\text{ and }d_1(s_5)\\
&=400,\ d_2(s_5)=100.\\
H(s_6)=d(s_6)&=\{(s_1^2,s_2^3)\}\text{, i.e., }H(600)\\
&=\{400,200\}\text{ and }d_1(s_6)\\
&=400,\ d_2(s_6)=200.
\end{aligned}$$

We are now able to define the notion of an *induced event* in a subsystem. Intuitively, an induced event is simply one which occurs in a subsystem as a manifestation of an event in the system. By focusing on induced events, the auditor can identify those subsystems that are affected when an event occurs in the system. Thus, if an event that was previously lawful becomes unlawful (or vice versa) because structural modifications have been made to a system, the auditor can identify those subsystems that will be affected via the set of induced events. Control changes may be needed in these subsystems. In this light, induced events are fundamental to the approach used to reduce the search space of control and audit procedure changes needed. More precisely, we have:

> *Definition 21*: Let $<s,s'>$ be an event in the possible event space of a system, $<s,s'>\in E(\sigma)$. Let $d(s)$ and $d(s')$ be the corresponding states in $2^{S(D)}$. Furthermore, let $d_i(s)$ and $d_i(s')$ be the state of the ith subsystem when the system is in states s and s', respectively. Then the pair $<d_i(s),d_i(s')>$ will be called an *induced event* on subsystem $x_i<\sigma$ iff $d_i(s)\neq d_i(s')$. The induced event on the subsystem x_i will be designated e_1.

To illustrate the notion of an induced event, assume that the event $<s_2,s_3>$ occurs in the payroll system. That is, the system moves from $s_2=\$200$ to $s_3=\$300$. Via the mapping H, $d(s_2)$ and $d(s_3)$ are the corresponding states in $2^{S(D)}$. In our example, $d(s_2)=\{(s_1^1,s_2^2)\}=\{(100,100)\}$ and $d(s_3)=\{(s_1^1,s_2^3)\}=\{(100,200)\}$. Consequently:

$$\begin{aligned}
&d_1(s_2)=s_1^1=100,\\
&d_2(s_2)=s_2^2=100,
\end{aligned}$$

---

[7] Recall, the power set of a set is the family of all the subsets of the set. Lemma 1 recognizes that a single state of the system may be manifested in more than one combination of subsystem states. For example, if Total has a value of \$900, it may be that Base has a value of \$600 and AddP has a value of \$300 or Base has a value of \$500 and AddP has a value of \$400. That is, H:900 → {(600,300), (500,400)}. Again, to simplify matters, we have assumed that each system state maps into only one combination of subsystem states.

$d_1(s_3)=s_1^1=100$, and
$d_2(s_3)=s_2^3=200$.

Since $d_1(s_2)=d_1(s_3)$, no induced event has occurred in the base pay subsystem x_1. However, since $d_2(s_2)\neq d_2(s_3)$, an induced event has occurred in the additional payments subsystem x_2.

Finally, we extend these ideas to show how an induced event in a subsystem in turn propagates to its own subsystems. Accordingly, we define a *level structure* over a system:

> *Definition 22*: Let $D(\sigma)$ be a decomposition on σ, and let $L=\{L^i \mid i=1,\ldots,n\}$ be a partition of $D(\sigma)$. Then a *level structure*, $\tilde{L}=<L,<>$ on $D(\sigma)$ is defined *recursively* as follows:
>
> (a) (Basis). $L^0=\{\sigma\}$.
> (b) (Induction Step). L^{i+1} (i=0,..., $n-1$) is a (finite) nonempty set of subsystems such that $(\forall x)[x\in L^{i+1} \Rightarrow (\exists y)(y\in L^i \wedge x<y)]$.

Figure 1 shows the level structure for the payroll system example. The top level, level 0, constitutes the payroll system itself. Level 1 comprises the base pay, additional payments, and benefits subsystems. Level 2 comprises the overtime and commission subsystems.

To understand better how changes to the conditional lawful event space of a system affect controls and audit procedures in the system, we relax the assumption that a change in the conditional lawful event space of a system requires a change in the controls over the system. A change in controls will not be needed, however, if (a) changes are made instead to controls over lower-level subsystems of the system, and (b) these subsystem controls ensure that events in the system will be correctly designated as lawful or unlawful because they correctly designate induced events in the subsystems as lawful or unlawful. At one extreme, controls would only be needed over the lowest-level subsystems in a system if these controls correctly designated all events in higher-level systems as lawful or unlawful. Unfortunately, matters are not so simple.

As a basis for analysis, we propose an important theorem:

> *Proposition 1*: Relation between Lawful and Unlawful Events at the System and Subsystem Levels:
>
> (a) Let $e\in E_L(\sigma)$. Then all the induced events in the subsystems of σ are lawful, i.e., $\forall\ e_i,\ e_i\in E_L(x_i)$.
> (b) Let $e\notin E_L(\sigma)$ and let $\tilde{L}$ be a level structure on σ. Then $(\exists L^k\in\tilde{L})$ $(e_i\in E(x_i) \mid e_i\notin E_L(x_i) \wedge x_i\in L^k)$.

The first part of Proposition 1 states that a lawful event in a system induces lawful events in its subsystems. Changes to controls and audit procedures will not be needed if only lawful events are induced in subsystems. In short, the existing controls equilibrium will be maintained.

The second part of the theorem recognizes that an *unlawful* event at the system level in a given decomposition of a system may induce only *lawful* events in the subsystems of the decomposition. This possibility may not be obvious at first, but intuitively it means that it is the pattern or configuration of induced events in the subsystems that is unlawful. In the context of the payroll system, commission and overtime calculations may be lawful in their respective subsystems, but it could be unlawful to combine them in the additional payments subsystem if, say, an office worker received more in commissions than overtime.

Many other real-world examples also illustrate the importance of the second part of Proposition 1. The computer hacker's objective, for example, is to decompose an unlawful event into a set of lawful sub-events so that the controls in the system can be circumvented—the "hacker's dilemma"! And, in the domain of inference controls over statistical databases, a formal technique called the "tracker" enables would-be perpetrators of an irregularity to decompose an unlawful query on a database into a set of lawful sub-queries [Denning and Schlörer, 1983].

The issue, therefore, is where to place controls in a system so that these unlawful events will be signalled even though they are lawful events in the subsystems. We do not address this issue further, because at this time we have no formal solution.[8] However, the answer lies in placing controls over supersystems that contain the affected subsystems. In essence, a supersystem control identifies when the set of lawful events that occurs in its subsystems represents a pattern, *in toto*, that is unlawful. In the degenerate case, controls must be placed over the highest-level supersystem, namely, the system itself. This solution is expensive, however, because the lawful event space of the system is larger than the lawful event space of its subsystems. Moreover, for all practical purposes, the lawful event space in many systems is nondenumerable. It is desirable to choose lower-level supersystems such that the controls over these supersystems will identify unlawful patterns of lawful events in the subsystems.

IV. EXTENSIONS TO THE MODEL

Our model can be extended in several ways to improve its usefulness as a basis for designing controls and audit procedures. Accordingly, each of the topics examined in the following subsections constitutes a research issue.

Decomposition of Controls

The term "decomposition of controls" refers to the process of applying controls at subsystem levels to capture unlawful events at the system level. It is usually advantageous to "push" controls down to the lowest possible level in a level structure so sources of problems can be diagnosed more accurately. Furthermore, as system changes occur, control changes can be localized to only those subsystems affected by the changes.

To illustrate these notions, let $D(\sigma)=\{x_i|i=1,\ldots,n\}$ be any decomposition of σ. Assume each subsystem x_i has a control K_i with transfer function f_i. Proposition 1(a) states that all the induced events at the subsystem level are lawful if an event is lawful at the system level. Namely: (1) $f_K(e)=1 \Rightarrow f_i(e_i)=1, \forall\ x_i \in D(\sigma)$ (where e_i is the induced event on x_i).

For a decomposition of controls to be complete, however, requires that if a law is broken, there must be *at least one* level at which a control will detect the unlawful event. Hence: (2) $f_K(e)=0 \Rightarrow \exists\ K_i$ at a certain level where $f_i(e_i)=0$.

From (1) and (2), it follows that (3) $f_K=\Pi f_i$, where the product is over all subsystems. We term this result "the equivalence of controls."

There may be more than one way to define controls for a given decomposition that will satisfy the equivalence of controls. Several questions of practical interest are: Can a "good" control decomposition be defined? If yes, what are the criteria for "goodness"? How do we deduce the control configuration, given these criteria, from the system laws?

---

[8] A solution requires that we have a formal theory of decomposition of controls, which in turn requires a formal theory of decomposition of systems (since we have defined controls to be systems). Unfortunately, a general theory of decomposition of systems remains a fundamental, unsolved problem [Courtois, 1985]. Section IV addresses this issue further.

Event-Dependent vs. State-Dependent Controls

By definition, a lawful event can only happen between two lawful states: $\forall e = <s,s'>,\ s \notin S_L(\sigma) \vee s' \notin S_L(\sigma) \Rightarrow e \notin E_L(\sigma)$. Consequently, events can be examined first to determine whether their beginning and end states are unlawful before the lawfulness of the transition is checked. This procedure may simplify the definition of control functions because often many events have the same beginning (or end) state. More formally, if we examine the control transfer function, state-only dependent controls may be expressed as: $f_K(<s,s'>) = f(s) \cdot f(s')$.

In many cases, it is unclear whether an event-dependent control is also a state-dependent control. For example, overdrawing a bank account may be considered an unlawful operation *per se*, or it may be unlawful because the ensuing state "negative balance" is an unlawful state. It seems important, therefore, to define the conditions under which event-dependent controls become state-dependent controls.

The Principle of Adjacency

To improve audit efficiency, the resources spent searching for subsystems requiring control changes must be reduced. We have previously presented the notion of induced events for this purpose. However, checking whether a (sub)system event induces lower-level events still may require extensive scanning of lower-level subsystems. Thus, we seek ways of identifying subsystems requiring control changes without having to scan all subsystems.

One possible search rule is based on the notion of *adjacency* [Davis, 1985]. Two subsystems are adjacent if one generates outputs that are inputs to the other. If the system generating outputs changes, adjacent systems may be affected. Thus, by analyzing adjacencies in a system decomposition, a search for control changes might be conducted more effectively.

Adjacency, as defined above, depends on exchanged commodities. Thus, different views (functional schemas) of the system may be needed. The adjacencies defined by data exchange and resource exchange are especially important. In computer systems, resources are quantities like processing power, storage capacity, and communication line capacity. The input/output relation means using a resource and auditors are concerned with controls over both data and resource commodities [Weber, 1988].

Control Stability

Design and audit of controls would be impractical if markedly different lawful event spaces existed in any two subsets of the state space. Often, however, the lawful event space $E_L(\sigma)$ does not vary greatly between different subsets of the state space. This notion is termed "control stability." More precisely, let S' and S'' be two subsets of $S(\sigma)$. Stability increases when the sizes of S' and S'' increase, and when the size of the symmetric difference of lawful events for S' and S'' decreases. Thus, the study of ways to partition $S(\sigma)$ into subsets to enhance the stability of the lawful event space may lead to ways of reducing control design and audit efforts.

V. CONCLUSIONS

The model presented here provides formal support for an intuitively appealing idea; namely, auditors should not have to reexamine *all* controls within a system when the system is modified. In addition, the model demonstrates that the extent to which a search can be localized depends upon the quality of both the system and the control decomposition. Moreover, our model shows that the protocol to be followed by auditors is not always straightforward if they undertake a localized search. Some errors or irregularities cannot be identified by controls placed over subsystems at a single level within the level structure of a system. In these circumstances, auditors must recognize that higher-level controls will be needed to identify patterns or configurations of simple events that manifest these problematical types of errors or irregularities.

These insights reveal the need to identify the characteristics of "good" decompositions and "good" level structures. Good decompositions and level structures are not only fundamental to good systems design, but also provide the foundation for good internal control system design and effective and efficient auditing.

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The Information in Discretionary Outlays: Advertising, Research, and Development

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ABSTRACT: Recent studies have considered the association between abnormal stock returns and forecast errors of various components of earnings. For discretionary outlays such as advertising or research and development (R&D), the sign and magnitude of the association between forecast errors and abnormal returns can provide information concerning the expected duration of benefits arising from these activities. This empirical study compares market reaction to advertising and R&D forecast errors with market reaction to forecast errors for conventional expenses, and with a theoretical benchmark for long-lived assets. The results are mixed, but on balance the evidence is consistent with a market assessment that advertising is short-lived while R&D is long-lived.

EXPENDITURES for advertising or R&D are excluded from firms' balance sheets by present accounting rules primarily because of the claimed difficulty in determining the magnitude of future benefits from these activities and difficulty in determining the length of time over which benefits will endure. A number of studies attempt to assess the duration of benefits from advertising outlays by examining a distributed lag relation between product sales and past advertising expenditures. The inconsistent results of such studies are summarized by Schmalensee [1972] and Norris [1984]. A smaller number of studies, including those by Branch [1974] and Ravenscraft and Scherer [1982], study a distributed lag relation between R&D input (expenditures) or output (patents), and profitability. These studies find a mean lagged relation of several years (four to six years in Ravenscraft and Scherer).

Two recent studies, Hirschey [1982] and Hirschey and Weygandt [1985], take a different approach by examining the relation between firms' market values and current period advertising and R&D outlays. As both studies note, use of stock prices to construct a dependent variable offers an attractive alternative

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to the previous distributed-lag studies, which used accounting sales or earnings data. Both studies conclude that advertising and R&D are long-lived and should be capitalized and amortized over time rather than expensed when incurred.[1]

The present study uses an alternative market-based research method based on Lipe [1986] to investigate the longevity of advertising and R&D. In Section I, we present the theory underlying an alternative empirical approach using stock returns and disaggregated earnings data to address the longevity issue. Section II describes the research design including forecasting models used and specific tests performed. Section III presents results and Section IV the conclusions.

I. AN EARNINGS COMPONENTS APPROACH

Several recent studies investigate the association between cumulative abnormal security returns (*CAR*) and unexpected changes in the levels of various revenue and expense components of earnings. Lipe [1986] investigates the association between *CAR* and the forecast errors of six components of earnings, using annual data on gross profits, general and administrative expense, depreciation, interest expense, income taxes, and other items. He finds that the component forecast errors explain more of the variation in *CAR* than do earnings forecast errors alone, and he concludes that some information is lost when the six components are aggregated into a single earnings number. This conclusion differs from the findings of Hopwood and McKeown [1985] who use only sales and total expenses, and who find that forecast errors for these components have no incremental information beyond that provided by earnings forecast errors alone. Lipe also investigates whether intercomponent differences in time-series properties of earnings components partially explain intercomponent differences in the magnitude of the relation between *CAR* and component forecast errors. He finds that components whose shocks tend to persist across time have a stronger association and concludes that return reactions to component shocks are positively related to the time-series properties of the components.[2]

Lipe mentions [1986, p. 52] that the market reaction to an unexpected change in an earnings component which is accompanied by a change in the level of an investment depends on whether the market evaluates the investment as a positive net present value project. We make explicit use of this line of reasoning to investigate whether advertising and R&D outlays can be best characterized as investments or expenses from a market perspective. The association of per-share advertising and R&D "forecast errors" with *CAR* should differ to some extent depending on whether all benefits of advertising and R&D are reflected in current versus future periods.

Consider a firm that makes an unexpected cash outlay that will yield cash inflows in the same and/or future periods. The market value of the firm decreases by the amount of the cash outlay but increases in an amount equal to the present value of current period and expected future cash flows from the project. The net change in the value of the firm, reflected in its periodic abnormal stock return, therefore, depends upon the project's net present value.[3] Assume for simplicity a setting in which accounting revenues and expenses correspond to cash flows. Focusing on advertising for the moment, let

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[1] Ettredge and Bublitz [1988] have extended the Hirschey and Weygandt [1985] study using a similar research method but with a larger, multi-year sample. These results strongly support the Hirschey and Weygandt results with respect to the longevity of R&D but, for a majority of years, do not agree concerning the longevity of advertising.

[2] Persistence is the present value of revisions in expected future earnings arising from a one-dollar shock in earnings or an earnings component.

$P_{i,t}$ = the per-share price of firm i at time t,
$SFEPS_{i,t}$ = the per-share sales forecast error (unexpected cash inflow) for the period ending at time t,
$ADFEPS_{i,t}$ = the per-share advertising forecast error (unexpected cash outflow) for the period,
$OEXFEPS_{i,t}$ = the per-share forecast error (unexpected cash outflow) for expenses other than advertising, and
$Z_{i,t}$ = the present value of *future* period cash inflows arising from the advertising forecast error.

All cash inflows resulting from an unexpected change in advertising are captured either in *SFEPS* or in *Z*. If the advertising shock, with its related effects on future cash flows, sales, and other expenses, is the only economic event affecting the firm in the period ending at time *t*, the change in per-share market price, which will be reflected in the periodic return, is:

$$P_{i,t}-P_{i,t-1}=SFEPS_{i,t}-ADFEPS_{i,t}-OEXFEPS_{i,t}+Z_{i,t}. \quad (1)$$

If advertising yields benefits only in the *current* period, then *Z* will have a value of zero. Any advertising forecast error should be accompanied by contemporaneous, unexpected cash flows for sales and cost of goods sold (a major component of other expenses). Consider the following linear regression model:[4]

$$P_{i,t}-P_{i,t-1}=A_0+B_1SFEPS_{i,t}+B_2ADFEPS_{i,t}+B_3OEXFEPS_{i,t}+e_{i,t}. \quad (2)$$

The coefficients for *SFEPS* and *OEXFEPS* should be positive and negative, respectively, and the coefficient for *ADFEPS* should be negative and the same as the coefficient for other expenses. That is, an unexpected increase in advertising outlays should be associated with a negative price response when controlling for contemporaneous changes in sales and other expenses.

If, instead, benefits from advertising occur only in *future* periods, then an unexpected increase in advertising for a given period will not be associated with same-period shocks in sales and other expenses. However, $Z_{i,t}$ will now be positive and will be reflected in the periodic return. If *Z* could be observed, its coeffient should be positive while the estimated coefficient for *ADFEPS* would be negative. Because *Z* is unobservable, however, it constitutes an omitted variable that is positively correlated with *ADFEPS* in a cross-sectional test. The estimated coefficient for *ADFEPS* will, therefore, be positively biased toward zero. In fact, if all benefits from advertising occurred in future periods and if advertising were a zero net-present-value project at the margin, Z would be perfectly and positively correlated with *ADFEPS*, and the slope coefficient of *ADFEPS* would be zero in the absence of a Z-variable.[5]

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[3] See Henderson and Quandt [1971, pp. 312–319] for a discussion of the neo-classical economic theory of investment, which typically assumes that firms face investment opportunities characterized by decreasing marginal internal rates of return. A profit-maximizing firm should increase the level of its investment in a given project until the marginal internal rate of return to the project equals the cost of capital or discount rate. Therefore, firms employing value-maximizing levels of advertising and R&D should be facing zero net-present-value projects at the margin. We view advertising and R&D forecast errors as marginal changes. Given that the value of the firm is assumed to be a concave function of advertising or R&D outlays, the linear form of equation (1) should be considered an approximation.

[4] In the cross-sectional regressions performed all variables are deflated by dividing by $P_{i,t-1}$. See Section II.

The above discussion suggests that the estimated coefficient of association between advertising or R&D forecast errors and returns will depend upon the longevity of benefits arising from these activities. If advertising and R&D outlays constitute expenses then, just as with other expenses, a negative coefficient of association with *CAR* should be observed, such as the negative partial correlation coefficient Hopwood and McKeown [1985] found for total expense forecast errors. If these outlays produce future-period cash flows, the present value of the cash flows constitutes a positively correlated omitted variable which would bias the estimated coefficients for advertising and R&D toward zero. Relaxing the assumption that accounting revenues and expenses correspond to cash flows should not invalidate the basic thrust of the analysis.

Estimated coefficients for returns with *ADFEPS* and *RDFEPS* can, therefore, be compared against two benchmarks. First, there is the "zero" measure described above. Unexpected investments in zero net-present-value projects which are long-lived should have no association with *CAR*. The first set of null hypotheses (H_{01} and H_{02}), described in Section II, are that the coefficients of association for *ADFEPS* or *RDFEPS* equal or exceed zero. Failure to reject the directional null hypotheses can be interpreted as an indication that unexpected outlays for advertising or R&D constitute long-lived, zero net-present-value investments. Alternatively, inability to reject the null hypotheses could be due to lack of power in the test—e.g., from measurement errors in our variables, a possibility we discuss in Section IV. Rejection of the null can be interpreted as implying that future period benefits of advertising and R&D are relatively small compared to current benefits. Rejection of the null could also result if firms do not use value-maximizing levels of advertising and R&D.[6]

As a second benchmark, the estimated coefficients for *ADFEPS* and *RDFEPS* can be compared with the estimated coefficient for Other Expense forecast errors. The second set of null hypotheses (H_{03} and H_{04}), are that coefficients of association between *ADFEPS* or *RDFEPS* and *CAR* are less than or equal to the coefficient of association between *OEXFEPS* and *CAR*. If the models are correctly specified, their inability to reject these nulls implies that advertising and R&D are treated like ordinary expenses in the valuation process. Rejection of the second set of null hypotheses suggests that advertising and R&D have future benefits. However, as with the first pair of hypotheses, caveats apply here. For example, rejection of null hypotheses H_{03} and H_{04} could be due to measurement error in the advertising and R&D variables rather than to longevity.[7]

We will also compare the longevity of advertising and R&D with one another. The null hypothesis (H_{05}), is that the coefficient for *RDFEPS* is less than or equal to the coefficient for *ADFEPS*. Rejection of the null implies that R&D is longer-lived than advertising as is suggested by the results of Hirschey [1982], Hirschey and Weygandt [1985], and Ettredge and Bublitz [1988].

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[5] See Kmenta [1971, pp. 392-393] for a discussion of specification error due to omission of a relevant explanatory variable. Our analysis is based on three assumptions. First, *ADFEPS* and Z are assumed to be positively correlated. Second, *CAR* and Z are assumed to be positively correlated. Third, the correlation between *ADFEPS* and *CAR* is assumed to be negative.

[6] For instance, if firms on average use "too much" advertising, an unexpected marginal increase in advertising could be associated with a negative abnormal return even if advertising is long-lived. We assume that firms employ value-maximizing levels on average.

[7] Note that for H_{01} and H_{02}, lack of power could result in an incorrect assessment that advertising and R&D are long-lived. For H_{03} and H_{04}, lack of power could lead to an incorrect assessment that advertising and R&D are expenses. The two sets of tests, therefore, complement one another.

II. RESEARCH DESIGN

Population Studied

Because advertising and R&D data are typically available on an annual basis only, we use annual rather than quarterly data. Because the primary focus of this study is advertising and R&D outlays, our sample consists of firms from four-digit standard industry classification (SIC) industries 2000 through 3999; in these industries it is common for firms to have both advertising and R&D. Sample firms have calendar fiscal years and appear on the COMPUSTAT annual industrial tape for the period 1973–1983, and on the daily CSRP tape for the period 1969–1984. The test period is 1974–1983 and qualified firms enter the sample as early as the availability of data allows (typically, in the first year advertising and R&D forecast errors can be computed).[8] These requirements result in a maximum (minimum) of 2,832 (1,325) annual observations for 328 (190) sample firms depending upon the specific variables included.

Unsystematic Security Returns

Rather than using per-share stock price changes as dependent variable, as in equation (2), we use the market model residuals for firm i in month t using a value-weighted market index of New York and American Stock Exchange firms.[9] The estimation period is a 60-month "rolling" period where data permit, and regressions are only run in estimation periods with at least 30 observations. Each such estimation period precedes a 12-month "window" encompassing annual earnings announcement dates of sample firms. The parameters estimated over each estimation period are used to calculate monthly unsystematic returns in the succeeding 12 months. These unsystematic returns are summed over the 12-month period to obtain cumulative abnormal returns, *CAR*. The 12-month accumulation periods run from nine months prior to the fiscal year-end through three months afterward.[10]

Forecast Errors

Earnings per share are decomposed as follows:[11]

$$EPS = SPS - ADPS - RDPS - OEXPS, \qquad (4)$$

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[8] For most firms, annual data on advertising and R&D expenses are available on COMPUSTAT beginning about 1972 or 1973, probably because of a 1972 revision of Regulation S-X requiring these data to be reported to the Security Exchange Commission as supplementary income statement information. The first year for which advertising and R&D forecast errors can be computed for a substantial number of firms is 1974, and this is the start of our test period.

[9] The CRSP daily market returns were used, with daily returns aggregated into monthly returns.

[10] A 12-month cumulation period ending three months after the fiscal year-end is common in returns studies employing annual earnings data, and was used by Beaver et al. [1979] among others. The lengthy cumulation period reflects the fact that quarterly reports and other data sources allow the market to anticipate annual *EPS*, to some extent, well in advance of its release.

Jennings [1986] suggests that, when market-wide factors are not removed from explanatory variables, raw returns rather than abnormal returns may be the appropriate dependent variable. We replicated the procedures using two alternative dependent variables: raw returns cumulated over calendar year periods, and raw returns cumulated over April through March periods. Use of a calendar year cumulation period in conjunction with the share price deflator results in standardization of the independent variables as recommended by Christie [1987]. Overall, the results when alternative dependent variables are used are quite similar to those reported.

[11] All per-share data throughout the study are adjusted to a comparable basis across years using COMPUSTAT's annual data item 27 to control for the effect on per-share data of stock dividends and splits.

where

EPS = COMPUSTAT annual data item 58, primary earnings per share excluding extraordinary items and discontinued operations,

SPS = COMPUSTAT data item 12, annual net sales, divided by data item 54, the number of shares used in computing primary EPS,

$ADPS$ = COMPUSTAT data item 45, annual advertising expense, divided by data item 54,

$RDPS$ = COMPUSTAT data item 46, annual R&D expense, divided by data item 54, and

$OEXPS$ = other expenses per share, a residual amount: ($OEXPS = SPS - EPS - ADPS - RDPS$).

Following recent studies which used annual data, such as Rayburn [1986] and Stober [1986], we deflate the independent variables using common share price at the start of the calendar year. Albrecht et al., [1977] provide evidence that the time-series of earnings deflated by the beginning of period stockholders' equity can be appropriately modeled as a random walk. Because of the short time-series of available annual data, we use the random walk forecast for earnings. Accordingly, our deflated earnings forecast error per share (*EFEPS*) for firm *i* in year *t* is:

$$EFEPS_{i,t} = (EPS_{i,t} - EPS_{i,t-1}) / P_{i,t-1}, \qquad (5)$$

where P = COMPUSTAT annual data item 24, year-end price per share.

Lack of an extensive time-series of advertising and R&D outlays precludes sophisticated time-series modeling. Fortunately, the behavior of changes in advertising and R&D outlays per share, deflated by per-share stock prices, appears to be white noise. Therefore, we use the random walk model to compute forecast errors for these earnings components and then deflate by start-of-period share price. This practice is common in current cost market studies for which short data histories prevail (e.g., Schaefer [1984] and Bublitz et al. [1985]).

Per-share forecast errors for earnings components were computed as:

$$ADFEPS_{i,t} = (ADPS_{i,t} - ADPS_{i,t-1}) / P_{i,t-1}, \qquad (6)$$

$$RDFEPS_{i,t} = (RDPS_{i,t} - RDPS_{i,t-1}) / P_{i,t-1}, \qquad (7)$$

$$SFEPS_{i,t} = (SPS_{i,t} - SPS_{i,t-1}) / P_{i,t-1}, \qquad (8)$$

$$OEXFEPS_{i,t} = (OEXPS_{i,t} - OEXPS_{i,t-1}) / P_{i,t-1}. \qquad (9)$$

Appropriate forecasting models should produce forecasts having means close to zero. Descriptive data for the above variables plus *CAR* appear in Table 1. Distributional characteristics of *SFEPS* and *OEXFEPS* are similar to one another, as are the distributional characteristics of *ADFEPS* and *RDFEPS*. Mean forecast errors for advertising and R&D differ from zero at a significance level of 0.01 or better as indicated in the table (two-tailed *t*-test), but still appear to be close to zero. Mean forecast errors for other earnings components, and for *EPS*, also differ significantly from zero. Deflated earnings and earnings components appear to be characterized by a slight positive drift.

Table 2 presents means and standard deviations of the auto-correlation coefficients of forecast errors for each of the first six annual lags: r_t, $t = 1, \ldots 6$.[12] If

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[12] Auto-correlations for each firm are based on up to 20 years of data (19 first differences) for the period 1964–1983. However, the estimated auto-correlation coefficients for advertising and R&D usually are based on a shorter time-series. Foster [1986, pp. 232–233] describes the estimator used.

TABLE 1

DESCRIPTIVE STATISTICS FOR FORECAST ERRORS AND ABNORMAL RETURNS
1974–1983 POOLED DATA (1,325 OBSERVATIONS FOR EACH VARIABLE)

Variable	*Mean* (t)	*Standard Deviation*	*Minimum*	*Maximum*
CAR[1]	0.0121 (1.238)	0.3557	−1.6864	7.1237
EFEPS	0.0114 (2.167)*	0.1915	−1.5805	3.8566
SFEPS	0.1994 (8.943)**	0.8116	−6.7975	9.0546
OEXFEPS	0.1774 (8.538)**	0.7563	−8.7000	8.4491
ADFEPS	0.0064 (5.958)**	0.0391	−0.6952	0.5633
RDFEPS	0.0043 (7.525)**	0.0208	−0.2350	0.1883

* Differs from zero at a significance of 0.05 (two-tailed *t*-test).
** Differs from zero at a significance of 0.001 (two-tailed *t*-test).
[1] *CAR* = Cumulative abnormal stock price return.
EFEPS = Earnings forecast error per share.
SFEPS = Sales forecast error per share.
OEXFEPS = Other expense forecast error per share (excludes advertising and R&D expense).
ADFEPS = Advertising forecast error per share.
RDFEPS = R&D forecast error per share.

the random walk forecasting model is descriptively valid, mean auto-correlations should be close to zero. Table 2 reveals that, for most lags and most variables, it is possible to reject the null hypothesis of zero auto-correlation. However, as Tables 1 and 2 indicate, the properties of component forecast errors are similar to the properties of earnings per share forecast errors, and earnings per share are known to be well-described by a random walk.

Table 3 presents Pearson correlation coefficients for dependent and explanatory variables used in Section II. This table reveals that sales and other expenses forecast errors are highly correlated.[13] Because multicollinearity may be present in the data, diagnostic measures of collinearity are obtained for each regression performed. The degree of collinearity present appears to be insufficient to degrade estimation results.[14]

Tests of Association for Advertising and R&D

In Section I, we hypothesize that the

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[13] In Section I, we suggest that if advertising or R&D are short-lived, forecast errors for these components may be contemporaneously associated with forecast errors for sales and/or other expenses. Table 3 indicates that the contemporaneous correlations between advertising forecast errors and forecast errors for sales and for other expenses are relatively higher than the correlations of R&D forecast errors with forecast errors for sales and for other expenses. These relations are consistent with advertising being shorter-lived than R&D. Also, the correlation between *ADFEPS* and *CAR* is negative and significant while the correlation between *RDFEPS* and *CAR* is close to zero.

[14] Collinearity diagnostics are based on procedures recommended by Belsley et al. [1980, p. 105]. They suggest that moderate to strong dependencies are associated with condition indexes of 30 to 100. The largest condition index observed in our regressions with pooled data was 13.

TABLE 2

DESCRIPTIVE STATISTICS FOR FORECAST ERROR AUTO-CORRELATIONS[1]
(1974–1983 POOLED DATA)

	Mean (Standard Deviation)[2]				
	EFEPS	SFEPS	ADFEPS	RDFEPS	OEXFEPS
r_1	−0.0847** (0.2385)	0.0417** (0.1788)	−0.1019** (0.3331)	−0.0052 (0.2863)	−0.0272 (0.3617)
r_2	−0.0276** (0.1703)	−0.0025 (0.1327)	−0.0531* (0.2547)	−0.0586** (0.2373)	−0.0800** (0.2195)
r_3	−0.0662** (0.1639)	−0.0383** (0.1276)	−0.1028** (0.2136)	−0.0673** (0.1997)	−0.1717** (0.2040)
r_4	−0.0578** (0.1392)	−0.0405** (0.1099)	−0.0900** (0.1939)	−0.0487** (0.1728)	−0.1241** (0.1785)
r_5	0.0318** (0.1546)	0.0359** (0.1216)	−0.0740** (0.1882)	−0.0291* (0.1605)	−0.0484* (0.1918)
r_6	−0.0221** (0.1391)	−0.0191** (0.1139)	−0.0634** (0.1751)	−0.0351** (0.1377)	−0.0360* (0.1562)

* Differs from zero at a significance of 0.01 (two-tailed t-test).
** Differs from zero at a significance of 0.001 (two-tailed t-test).
[1] r_t = mean estimated auto-correlation coefficient at lag of t years.
[2] The numbers in parentheses are the cross-sectional standard deviations upon which the t-tests are based.

coefficients of association between the dependent variable and advertising or R&D forecast errors should be less negative than the coefficient for conventional expense forecast errors if these outlays are long-lived. As was indicated above, the dependent variable and forecast variables are expressed in return form (divided by beginning-of-period price per share). In order to place the intercept in the same units, it too is expressed in return form. The following multiple regression model is estimated with pooled data for the ten-year period:

$$\begin{aligned} CAR_{i,t} = {} & A_0 SHARE + B_1 SFEPS_{i,t} \\ & + B_2 ADFEPS_{i,t} \\ & + B_3 RDFEPS_{i,t} \\ & + B_4 OEXFEPS_{i,t} \\ & + e_{i,t}. \end{aligned} \tag{10}$$

where $SHARE = 1/P_{i,t-1}$.[15] The hypotheses of interest using the "zero" benchmark are:

$$H_{01}:\ B_2 \geq 0,$$

and

$$H_{02}:\ B_3 \geq 0.$$

Inability to reject hypotheses H_{01} and H_{02} is consistent with marginal advertising and R&D outlays constituting long-lived, zero net-present-value investments. Rejection of the nulls implies that most

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[15] The correlations of the deflated intercept variable *SHARE* $(=1/P_{i,t-1})$ with the other variables are not presented in Table 3. The highest correlation of *SHARE* with another explanatory variable was 0.056 (with *RDFEPS*) which is significantly different from zero at a 0.002 level.

Equations (10), (11), and (12) are also estimated with a constant (undeflated) intercept and with the intercept suppressed. A variety of other modifications of model and data are also tried which are discussed in Section III. Results are the same as those reported with minor exceptions noted.

TABLE 3

PEARSON CORRELATION COEFFICIENTS

1974–1983 POOLED DATA (NUMBER OF OBSERVATIONS IN PARENTHESES)

	CAR	SFEPS	ADFEPS	RDFEPS
SFEPS	0.0861* (4,063)			
ADFEPS	−0.2173* (1,753)	0.4619* (2,285)		
RDFEPS	−0.0058 (2,832)	0.2360* (4,294)	0.1735* (1,712)	
OEXFEPS	−0.1073* (1,325)	0.9732* (1,712)	0.4266* (1,712)	0.2795* (1,712)

* Differs from zero at a significance of 0.001 (two-tailed *t*-test).

of the benefits of advertising and R&D expire in the current period.

The hypotheses of interest when the estimated coefficient of *OEXFEPS* is used as a benchmark are:

H_{03}: $B_2 \leq B_4$,

and

H_{04}: $B_3 \leq B_4$.

In addition, we wish to compare the coefficients for advertising and R&D forecast errors:

H_{05}: $B_3 \leq B_2$.

Inability to reject hypotheses H_{03} and H_{04} is consistent with advertising and R&D outlays being evaluated by the market as similar to conventional expenses. Rejection of H_{03} and H_{04}, given our analysis, is consistent with the outlays having long-lived benefits. That is, these types of outlays create intangible assets. Failure to reject H_{05} is interpreted as evidence that advertising and R&D are evaluated by the market as having equally long-lived (or short-lived) benefits. Rejection of H_{05} implies that the benefits of R&D are longer-lived than those of advertising.

The results of Hopwood and McKeown [1985] suggest that forecast errors for conventional expenses will have negative, significant coefficients; thus, B_4 is expected to be negative. The coefficient for sales forecast errors should be positive and significant.

The test statistic for a comparison of least squares estimators is [Kmenta, 1971, pp. 371-372]:

$$t=(\hat{B}_i-\hat{B}_j)/s,$$

where

$$s=[\mathrm{Var}(\hat{B}_i)+\mathrm{Var}(\hat{B}_j) \\ -2\ \mathrm{Cov}(\hat{B}_i,\hat{B}_j)]^{1/2}.$$

The *t*-statistic has $(n-5)$ degrees of freedom in equation (10), where n is the number of observations.[16]

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[16] Bernard [1987] presents evidence that cross-sectional dependence in stock returns data can bias Ordinary Least Squares (OLS) based statistics toward rejection of the null hypothesis of zero slope. The bias can be substantial when annual return metrics are regressed against firm-specific variables as in the current study. The cross-sectional correlation is strongest within industries. When the number of sample firms per industry is small, the bias is likely to be small. The mean number of sample firms per three-digit SIC industry in this study is only 2.73; the standard deviation is 2.52. Based on Bernard's results, we do not believe that this bias is a serious problem.

Equation (10) can only be estimated for firms reporting positive amounts of both advertising and R&D expense.[17] Because some firms employ either advertising or R&D but not both, the estimation requirements of equation (10) greatly reduce the available sample. Only 1,325 annual observations can be employed in estimating equation (10). In order to make use of additional data, the following models are also estimated:

$$CAR = A_0SHARE + B_1SFEPS + B_2ADFEPS + B_4OEXFEPS + e, \quad (11)$$

$$CAR = A_0SHARE + B_1SFEPS + B_3RDFEPS + B_4OEXFEPS + e. \quad (12)$$

Equation (11) is estimated with 1,753 observations and equation (12) with 2,832. Note that the coefficient notation of equation (10) is preserved in equations (11) and (12). Both the zero and Other Expense benchmarks are used for hypothesis testing.

Finally, equations (10), (11), and (12) were estimated with an additional explanatory variable:[18]

$$NEXT_{t+1} = SFEPS_{t+1} - OEXFEPS_{t+1}.$$

Variable *NEXT* is the deflated first difference in earnings, excluding advertising and R&D expenses. *NEXT*, when included as an explanatory variable in equations (10), (11), and (12), is a "leading" variable because it is the deflated difference between current period and *next* period earnings per share, excluding advertising and R&D.[19] *NEXT* may serve as a rough surrogate for benefits which period t advertising or R&D outlays will provide in period $t+1$. If it does, then a portion of the "omitted" variable Z, described in Section II, is now included in the model. This should tend to decrease the coefficient of association between *CAR* and *ADFEPS* if a substantial portion of benefits of advertising expire in the next period, i.e., inclusion of variable *NEXT* reduces bias due to the omitted variable.

The additional equations to be estimated are:

$$CAR = A_0SHARE + B_1SFEPS + B_2ADFEPS + B_3RDFEPS + B_4OEXFEPS + B_5NEXT + e, \quad (13)$$

$$CAR = A_0SHARE + B_1SFEPS + B_2ADFEPS + B_4OEXFEPS + B_5NEXT + e, \quad (14)$$

$$CAR = A_0SHARE + B_1SFEPS + B_3RDFEPS + B_4OEXFEPS + B_5NEXT + e. \quad (15)$$

Inclusion of variable *NEXT* in equations (13), (14), and (15) reduces the available sample size by more than ten percent due to the required first differencing and resultant loss of 1983 observations.

III. RESULTS

For comparison with Hirschey and Weygandt [1985] all models are estimated separately for durable goods pro-

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[17] For some firms, the COMPUSTAT data field for advertising expense contains a zero in many years rather than the missing value code. We treated these zeroes as missing data. Computation of advertising forecast errors using zeroes in adjacent years would lead to numerous "forecast errors" having a value of zero. This would tend to artificially lower the variability of this explanatory variable. Accordingly, forecast errors for all four components of earnings were only computed when adjacent years each had non-zero values recorded for each component.

[18] We wish to thank one of our two anonymous reviewers for this suggestion.

[19] Recent studies [Beaver et al., 1987; Collins et al., 1987] indicate that *CAR* for a given period is significantly related to earnings of subsequent periods.

TABLE 4

MULTIPLE LINEAR REGRESSION RESULTS FOR EQUATION (10) FOR NONDURABLE, DURABLE, AND COMBINED FIRM SAMPLE (1974–1983 POOLED DATA)

$$CAR = A_0 SHARE^{1} + B_1 SFEPS + B_2 ADFEPS + B_3 RDFEPS + B_4 OEXFEPS + e \qquad (10)$$

Estimated Coefficient, (t)						
A_0	B_1	B_2	B_3	B_4	*Adjusted* R^2	F
			All Firms $(N=1,325)$			
0.258 (10.71)**	0.406 (8.84)**	−2.837 (−11.59)**	0.015 (0.04)	−0.429 (−8.86)**	.203	68.71**
			Nondurable Goods $(N=593)$			
0.456 (6.33)**	0.416 (3.75)**	−0.400 (−1.16)	−1.199 (−1.02)	−0.450 (−3.75)**	.082	11.65*
			Durable Goods $(N=732)$			
0.236 (8.40)**	0.396 (7.22)**	−4.027 (−12.11)**	0.261 (0.50)	−0.408 (−7.09)**	.283	58.68**

* Significant at the .01 level (two-tailed).

** Significant at the .001 level (two-tailed).

[1] *SHARE*=Inverse of price per share at the start of the period.

ducers, nondurable goods producers, and all firms combined. Table 4 presents regression results for equation (10).[20] Table 5 presents results of the hypotheses tests.[21] Estimated coefficients for R&D forecast errors do not differ significantly from zero as predicted in H_{02}. Estimated coefficients for *ADFEPS* are negative and significant for all firms and for durable goods producers but not significantly different from zero for nondurable goods producers (H_{01}). The rejection of H_{01} but not H_{02} is consistent with the assertion that the present value of future cash flows associated with R&D has been omitted from the equation. Based on the "zero" benchmark, R&D appears to be long-lived but advertising, on average, is not. The differential market association for advertising versus R&D forecast errors is especially striking given the similarity of the distributions of the two variables as shown in Tables 1 and 2.

Results of tests of hypotheses H_{03}, H_{04}, and H_{05} for equation (10) differ from those of hypotheses H_{01} and H_{02} to some extent. The former tests use the estimated coefficient of *OEXFEPS* as the benchmark for comparison and, in addition, compare the coefficients of *ADFEPS* and *RDFEPS* with one another. For H_{03} we fail to reject the directional null for all three samples. Results of

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[20] The distributions of error terms for equations (10) and (13) are similar. Both distributions, when compared to the normal, tend to be thin in the tails and bunched toward the center, and both exhibit slight positive skewness. Overall, regression diagnostics for the models estimated reflect general compliance with the assumptions underlying multiple least-squares regression.

[21] A negative *t*-statistic in Tables 5 and 7 indicates an estimated coefficient opposite in sign to that specified by the alternate hypothesis.

TABLE 5

RESULTS OF TESTS FOR EQUATION (10) REGRESSION SLOPE COEFFICIENTS: NONDURABLE, DURABLE, AND COMBINED FIRM SAMPLES (1974–1983 POOLED DATA)

$$CAR = A_0SHARE + B_1SFEPS + B_2ADFEPS + B_3RDFEPS + B_4OEXFEPS + e \quad (10)$$

Null Hypotheses	*t-statistics*[1] All Firms (*N*=1,325)	Nondurable Goods (*N*=593)	Durable Goods (*N*=732)
H_{01}: $B_2 \geq 0$	11.59*	1.16	12.11*
H_{02}: $B_3 \geq 0$	−0.04	1.02	−0.50
H_{03}: $B_2 \leq B_4$	−9.72*	0.15	−10.73*
H_{04}: $B_3 \leq B_4$	1.01	−0.63	1.29
H_{05}: $B_3 \leq B_2$	5.46*	−0.62	6.68*

* Significant at the .001 level (one-tailed).

[1] A negative *t*-statistic indicates an estimated coefficient opposite in sign to that specified by the alternate hypothesis.

the tests of H_{04} indicate that, while the estimated coefficient for *RDFEPS* typically exceeds that of *OEXFEPS* as expected, the difference is not statistically significant. This appears to be due primarily to the large standard error of the *RDFEPS* coefficient estimate. In tests of H_{05}, the estimated coefficient of *RDFEPS* exceeds that of *ADFEPS* as predicted in two of the three estimations. Overall, the Table 5 results using *OEXFEPS* as a benchmark do not allow rejection of the hypothesis that R&D is treated similar to a conventional expense in the valuation process. Advertising differs from a conventional expense, but not in a direction that implies it is long-lived.[22]

In addition to the functional forms of equations (10), (11), and (12) described above, modified versions are estimated with constant (undeflated) intercepts and with intercepts suppressed. The equations are also estimated with all variables standardized using the procedure of Bowen et al. [1987].[23] Alternative versions of the dependent variable include raw returns cumulated over different 12-month periods. Finally, the equations are estimated with each variable truncated at plus or minus ten of its own standard deviations.[24] The results reported above are basically the same across all these modifications. However, for two modified versions H_{04}, the hypothesis that the

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[22] Equations (11) and (12) results for pooled data are not presented but essentially agree with those of equation (10). Because equations (11) and (12) allow estimation with more observations than equation (10), they are estimated for each of the ten years separately.

[23] Before summing a firm's unexpected returns, each month's unexpected return is standardized by an estimate of the standard deviation of the residuals for that firm during the estimation period. A similar scalar is used to standardize the independent variables.

[24] The magnitude of the advertising coefficient appeared to be sensitive to outliers. For instance, the coefficient for *ADFEPS* reported in Table 4 for All Firms, −2.837, increases to −1.497 with truncation. With truncation and standardization using the procedure of Bowen et al. [1987] the coefficient increases to −1.307, but remains significantly more negative than the coefficient for *OEXFEPS*. Estimated coefficients for other variables are barely affected by truncation or standardization.

TABLE 6

MULTIPLE LINEAR REGRESSION RESULTS FOR EQUATION (13) FOR NONDURABLE, DURABLE, AND COMBINED FIRM SAMPLES (1974–1982 POOLED DATA)

$$CAR = A_0 SHARE + B_1 SFEPS + B_2 ADFEPS + B_3 RDFEPS + B_4 OEXFEPS + B_5 NEXT^{1} \qquad (13)$$

Estimated Coefficient, (t)						
A_0	B_1	B_2	B_3	B_4	B_5	Adjusted R^2
			All Firms ($N=1,119$)			
0.238 (9.36)**	0.409 (8.12)**	−2.950 (−11.25)**	0.832 (1.69)	−0.439 (−8.30)**	0.182 (3.63)**	.221
			Nondurable Goods ($N=505$)			
0.297 (3.87)**	0.752 (4.98)**	−0.916 (−2.34)*	−1.178 (−0.85)	−0.744 (−4.57)**	0.429 (3.41)**	.111
			Durable Goods ($N=614$)			
0.222 (7.48)**	0.379 (6.38)**	−4.075 (−11.48)**	1.116 (1.92)	−0.408 (−6.58)**	0.151 (2.51)*	.306

* Significant at the .05 level (two-tailed).
** Significant at the .001 level (two-tailed).
[1] *NEXT* = *SFEPS* − *OEXFEPS* for the next period.

coefficient for *RDFEPS* is the same as that for *OEXFEPS*, is rejected in favor of the alternate hypothesis for all firms and durable goods producers—i.e., R&D is long-lived. For all other versions of equation (10) the estimated coefficient for R&D typically exceeds that for other expenses, although the differences are not significant. Equations (10), (11), and (12) results, therefore, provide mixed evidence with respect to longevity of R&D using other expenses as benchmarks. The evidence for advertising is clear: advertising is evaluated as an expense.

Estimation results for equation (13) are presented in Table 6. As expected, inclusion of *NEXT* makes the estimated coefficient of *ADFEPS* more negative, although this effect is primarily confined to producers of nondurable goods.[25] In contrast to the equation (10) results, *ADFEPS* has a negative, significant coefficient for all three industry groupings in Table 6. Inclusion of *NEXT* makes estimated coefficients for *RDFEPS* more positive; however, for all three industry groupings, estimated coefficients for *RDFEPS* still do not differ significantly from zero.

Table 7 presents results for equation (13) hypotheses tests in the same format as Table 5. Results are generally consis-

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[25] Equations (10), (11), and (12) are reestimated with the same reduced samples used to estimate equations (13), (14), and (15). The different results arising from inclusion of the variable *NEXT* in the latter models do not appear to be due primarily to the reduction in the sample. For instance, when equation (10) is estimated for All Firms with the reduced sample, H_{04} is not rejected at conventional levels of significance. When equation (13) is estimated with the same sample, H_{04} is rejected.

TABLE 7

RESULTS OF TESTS FOR EQUATION (13) REGRESSION SLOPE COEFFICIENTS: NONDURABLE, DURABLE, AND COMBINED FIRM SAMPLES (1974–1982 POOLED DATA)

$$CAR = A_0SHARE + B_1SFEPS + B_2ADFEPS + B_3RDFEPS + B_4OEXFEPS + B_5NEXT \quad (13)$$

	t-statistics[1]		
Null Hypotheses	*All Firms* (*N*=1,119)	*Nondurable Goods* (*N*=505)	*Durable Goods* (*N*=614)
H_{01}: $B_2 \geq 0$	11.25***	2.34*	11.48***
H_{02}: $B_3 \geq 0$	−1.69	0.85	−1.92
H_{03}: $B_2 \leq B_4$	−9.51***	−0.47	−10.23***
H_{04}: $B_3 \leq B_4$	2.59**	0.31	2.64**
H_{05}: $B_3 \leq B_2$	6.50***	0.17	7.31***

* Significant at the .05 level (one-tailed).
** Significant at the .01 level (one-tailed).
*** Significant at the .001 level (one-tailed).
[1] A negative *t*-statistic indicates an estimated coefficient opposite in sign to that specified by the alternate hypothesis.

tent with those in Table 5 with the following exceptions. First, the hypothesis that the coefficient for *ADFEPS* equals zero, H_{01}, can be rejected for any of the three industry groupings. Second, the null hypothesis that the coefficient for *RDFEPS* is the same as the coefficient for Other Expenses, H_{04}, can now be rejected for all firms and for producers of durable goods. Results of estimation of equations (14) and (15) are not presented but agree closely with the equation (13) results presented in Table 7. As was the case with equations (10), (11), and (12), alternative versions of equations (13), (14), and (15) were estimated using constant and suppressed intercepts, and both standardized and unstandardized variables. The results were highly consistent with those presented.[26]

IV. SUMMARY AND CONCLUSIONS

This study compares the association of cumulative abnormal stock returns with unexpected advertising and R&D outlays relative to two benchmarks: a theoretically derived coefficient of zero, and the coefficient of cumulative abnormal returns with unexpected conventional expenses. Annual earnings per share data are decomposed into four components: per-share sales, advertising, R&D, and other expenses. Forecast errors are computed for each component. Monthly abnormal returns, cumulated over a 12-month period, are used as the dependent variable in regressions with the four earnings-component forecast errors used as independent variables. The regressions are then repeated, with a fifth explanatory variable designed to capture the earnings benefits of advertising or R&D one period after these outlays occur.

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[26] Equations (13), (14), and (15) are also estimated with the alternative dependent variables described in footnote 10. Frequently the R&D coefficient is significantly larger than the coefficient for Other Expenses.

TABLE 8

SUMMARY OF TEST RESULTS BY MODEL, INDUSTRY, AND EMPIRICAL BENCHMARK: EVALUATION OF ADVERTISING AND R&D AS EXPENSES OR ASSETS

	Model Estimated			
	Equation (10)		*Equation (13)*	
Benchmark Used	*Advertising*	*R&D*	*Advertising*	*R&D*
		All Firms		
Zero	Expense (H_{01})	Asset (H_{02})	Expense (H_{01})	Asset (H_{02})
Other Expenses	Expense (H_{03})	Expense (H_{04})	Expense (H_{03})	Asset (H_{04})
		Nondurable Goods		
Zero	Asset (H_{01})	Asset (H_{02})	Expense (H_{01})	Asset (H_{02})
Other Expenses	Expense (H_{03})	Expense (H_{04})	Expense (H_{03})	Expense (H_{04})
		Durable Goods		
Zero	Expense (H_{01})	Asset (H_{02})	Expense (H_{01})	Asset (H_{02})
Other Expenses	Expense (H_{03})	Expense (H_{04})	Expense (H_{03})	Asset (H_{04})

Zero Benchmark: Estimated coefficients for advertising and R&D forecast errors are compared with a theoretical benchmark of zero for long-lived assets.

Other Expenses: Estimated coefficients for advertising and R&D forecast errors are compared with estimated coefficients for the forecast errors of other expenses.

Conclusions from the hypotheses tests depend to some extent upon which of the two coefficient benchmarks is most appropriate. The "zero" benchmark has two advantages. First, the benchmark is not subject to estimation error as is the case with the coefficient for conventional expenses. Second, conventional expenses contain components which, although not long-lived themselves, may be correlated with assets which are long-lived. For instance, unexpected increases in interest expense or depreciation which are associated with new investment in positive or zero net-present-value plant asset projects would tend to increase the estimated coefficient for conventional expenses.

A summary of the test results, as they relate to classification of advertising and R&D as expenses or intangible assets, is presented in Table 8. For 11 of the 12 tests presented, advertising is classified as an expense. Results for advertising, therefore, do not support those of Hirschey [1982], or Hirschey and Weygandt [1985], and are closer to those of Ettredge and Bublitz [1988]. On balance, it appears that R&D outlays made by durable goods producers are evaluated as assets, while results for producers of nondurable goods are mixed. When these subsamples are pooled, R&D outlays of "all firms" are evaluated as assets.

Although our results are consistent with R&D being long-lived, alternative explanations are possible. First, estimated coefficients for R&D forecast errors would be close to zero if these outlays are simply price-irrelevant noise. However, R&D expenses reported by firms should be highly correlated with contemporaneous cash outflows for these purposes, so this explanation is not persuasive. Second, R&D expenses may have zero persistence in the sense of Lipe [1986]. That is, the levels of R&D expense could have zero auto-correlations, and the correlations between R&D expense and lagged sales could be zero. But this seems unlikely given the near zero auto-correlation of the differenced series shown in Table 2.[27] Third, the random walk forecasting model might be more valid for some earnings components than for others. If so, this could induce the observed results. An additional *caveat* is that our estimation method imposes common coefficients across all firms and time periods within the sample or subsample, whereas coefficients may actually vary across firms or over time.

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[27] Because there are, on average, fewer than ten annual observations per firm, we are unable to decisively reject these possibilities. The mean auto-correlation of per share advertising expense (deflated by start-of-period stock price per share) for one lag is 0.38; the mean auto-correlation of deflated R&D at one lag is 0.53. However, these mean auto-correlations do not differ from zero at conventional levels with a cross-sectional *t*-test.

We also examine lagged correlations between levels of annual advertising, R&D, and sales per share, each deflated by start-of-period stock price per share. Although the data suggest positive correlations with sales for at least two lags (one lag) for R&D (advertising), none of the mean lagged correlations differs significantly from zero with a cross-sectional *t*-test. Our procedure is necessarily crude due to the short time series of advertising and R&D data. Prior research using different data bases provides better evidence of the persistence of R&D. Branch [1974] and Ravenscraft and Scherer [1982] are examples of studies indicating a lagged relation between R&D and profitability.

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NOTES

On the Association of Cash Flow Variables with Market Risk: Further Evidence

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ABSTRACT: The purpose of this study is to determine whether funds and cash flows possess incremental information beyond accrual earnings in the context of explaining market risk. The results indicate that funds and cash flow risk measures (betas) provide significant incremental explanatory power over that provided by the earnings risk measure (beta) in explaining the variability in market betas. Additionally, the results reveal that an earnings beta does not possess additional explanatory power beyond that provided by either funds or cash flow betas. The major implication of the results is that with respect to the explanation of market risk, the information in accrual earnings appears to be a subset of the broader set of information contained in cash flows.

THIS paper investigates whether cash flow-based measures of risk have an incremental ability to explain cross-sectional variation in market betas beyond that provided by earnings-based risk measures. The findings of this research provide evidence regarding: (1) the importance of cash flows in forming expectations about firms' performance; (2) the consistency of cash flow data with security valuation models; and (3) whether cash flows supply information on a firm's risk beyond that already provided by accrual earnings. The evidence gives a basis for evaluating policy makers' recent efforts to establish cash flow reporting standards.

The next section discusses the background for the study. Section II deals with the method. Section III presents the empirical findings, and the summary and discussion of the results are provided in Section IV.

I. BACKGROUND

The Financial Accounting Standards Board's (FASB) conceptual framework considers providing information on an enterprise's cash flow generating ability as the underlying objective of financial

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reporting[1] [FASB, 1978; 1984]. This objective is consistent with the prominence of the relation between expected future cash flows and security value/risk in the modern theory of finance. While the FASB stresses the importance of cash flows, it, nevertheless, adopts the view that accrual earnings may provide a better indicator of enterprise performance than information about current cash flows [FASB, 1978, par. 44; 1984, par. 24].

The hypothesis that accounting earnings is an empirical surrogate for (or indicator of) future cash flows underlies the alleged utility of earnings in assessing security value/risk. The hypothesis is somewhat logical given that the nature of the income determination process is a transformation of basic cash flows into accrual-based earnings. More importantly, the idea that earnings is a surrogate for future cash flows is consistent with the evidence that conclusively supports the relation between earnings and security prices (for a review see Abdel-Khalik and Keller [1979], Beaver [1981, ch. 5], and Lev and Ohlson [1982]).

The idea that current earnings may be a better surrogate for future cash flows than current cash flows is not without critics. The critics express concern about some perceived deficiencies in the current reporting system, e.g., accounting for deferred taxes, pension liabilities, and inflation. Questions are also raised about the motivation behind the selection of accounting procedures, from within those generally accepted, by managers of firms with earnings-based compensation plans.[2] A number of researchers, therefore, have suggested a fundamental change in financial reporting toward more emphasis on cash flow-based measures. There are several rationales for these suggestions. First, cash flows are relatively "harder" than those resulting from the application of the accrual-based rules [Ijiri, 1980; Lee, 1981; and Thomas, 1975]. The contention is that a cash flow system possesses certain desirable properties of being more objective, simple, and easy to understand. Second, an excessive emphasis on earnings as a performance indicator undermines and is inconsistent with the economic rationale of cash flow-based investment decisions [Ijiri, 1978 and 1980; Stern, 1976; and Ferrara, 1976 and 1981]. Third, a cash flow reporting system properly captures the inflation impact given that an appropriate time value rate is applied to discount periodic cash flows [Lee, 1978 and 1981; Lawson, 1978 and 1980].[3]

Most of the early empirical work that tried to assess the relative information content of earnings and cash flows employed cash flow proxies by adjusting earnings for some, but not all, accruals. In particular, the funds flow variables often tested were either earnings plus depreciation or earnings plus depreciation and deferred taxes. Examples include Ball and Brown [1968], Fama and Babiak [1968], Beaver and Dukes [1972], Patell and Kaplan [1977], Baran et al. [1980], and Beaver and Landsman [1983]. With the exception of Baran et al., these studies generally failed to find evidence that the funds flow variables possess information beyond that of earnings. In related research, Gombola and Ketz [1983],

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[1] The FASB has recently issued SFAS No. 95 establishing standards for reporting cash flows in the financial statements, superseding APB Opinion No. 19 [FASB, 1987].

[2] Healy's [1985] results suggest that managers manipulate accrual earnings in an attempt to increase their compensation. For a review of related theoretical and empirical issues, see Watts and Zimmerman [1986, chaps. 9 and 11].

[3] Lawson [1980] uses the tax-neutrality principle to argue that a cash flow-based tax system could have lessened the impact of the 1974 financial crisis in Britain.

Thode et al. [1986], and Bowen et al. [1986] have reported that the statistical properties of earnings and funds flow variables are quite similar while those of earnings and more completely adjusted cash flow variables are different. Therefore, the similarity in the properties of earnings and funds flows has been offered as an explanation for the failure of early research to find incremental information in funds flows over that provided by earnings. Further, because of the dissimilarity in their characteristics, it has been hypothesized that cash flows have potential information not captured by either earnings or funds flows [Gombola and Ketz, 1983; Bowen et al., 1986].

Recent stock return association studies by Rayburn [1986], Wilson [1986 and 1987], and Bowen et al. [1987] have incorporated properly specified (i.e., fully adjusted) cash flow variables into the analysis. These studies have generally concluded that earnings provide information that is not contained in cash flows alone. Additionally, they document that cash flows possess differential information relative to earnings and funds flow variables. Consistent with the early work, however, the recent research fails to find evidence that funds flows have incremental information relative to earnings.

The issue of the relative ability of cash flows and earnings to explain market risk has not been addressed in prior research. Moreover, notwithstanding the central role that market risk plays in determining a security's expected return, the results of the recent security return-based research about the information in cash flows versus earnings may not be applicable to risk assessment. The following reasoning is offered. Accruals (especially current accruals) can offset or cancel the transitory component of current cash flows so that unexpected earnings is a better proxy of unexpected permanent earnings than is the current amount of unexpected cash flows. For example, Rayburn [1986] reports that accounting earnings exhibit lower variability than cash flows. The dampening effect of the accounting accrual process may mean that the earnings series will produce a risk measure that is a poorer proxy of market risk than would the corresponding cash flow series. From this perspective, the major research question of this paper is: Do alternative measures of cash flow capture dimensions of market risk beyond that captured by earnings information?

II. METHOD

This study is conducted in the spirit of the early works by Beaver et al. [1970], Hamada [1972], Beaver and Manegold [1975], and more recently by Bowman [1979 and 1980], Baran et al. [1980], Beaver et al. [1982], and Beaver and Landsman [1983], establishing the empirical/theoretical relation between accounting variables and market risk. The research design is structured primarily on the basis of a multiple regression model with market beta as the dependent variable and accounting betas as the independent variables. The analysis is directed at testing the significance of the incremental explanatory power, with respect to the variability in market beta, of the earnings, funds flows, and cash flow risk measures relative to each other. Fundamentally, the method of analysis is a market risk association test.

Market Beta

Monthly stock returns over 1967–1985 period were used in deriving empirical estimates of market beta from the familiar market model:

$$\tilde{R}_{it}=\alpha_i+\beta_i\tilde{R}_{mt}+\tilde{u}_{it},$$

where

$\tilde{R}_{it}$ = rate of return on security i in period t,
α_i = intercept,
β_i = market beta for security i,
$\tilde{R}_{mt}$ = rate of return on market portfolio (S&P 500 value weighted index), and
$\tilde{u}_{it}$ = disturbance term with $\mu(\tilde{u}_{it})=0$ and constant variance.

Accounting Betas

Annual observations, over the same period (1967–1985), were relied on to estimate accounting betas using the time-series regression:

$$\tilde{r}_{it}=a_i+b_i\tilde{r}_{mt}+\tilde{e}_{it},$$

where

$\tilde{r}_{it}$ = an accounting return variable for firm i in period t,
a_i = intercept for firm i,
b_i = accounting beta for firm i,
$\tilde{r}_{mt}$ = market index for accounting returns computed as the simple average of the sample accounting returns, $\tilde{r}_{it}$, in period t, and
$\tilde{e}_{it}$ = disturbance term with $\mu(\tilde{e}_{it})=0$ and constant variance.

Beta estimation errors have been noted in earlier studies (e.g., Blume [1971], Levy [1971], and Fama and MacBeth [1973]) due to the effect of nonstationarity of the beta coefficients. Two approaches were followed in an attempt to circumvent the problems associated with these errors: (1) Vasicek's Bayesian technique [1973] was applied to adjust the initial estimates of both market and accounting betas at the individual firm level, and (2) the analysis was also conducted at a ten-security portfolio level (formed on the basis of a ranking on market beta for the period examined).

Accounting Return Variables

Four accounting return variables were investigated: an earnings measure, two funds flows measures, and a cash-flow measure. For each year, t, these returns are defined from COMPUSTAT data items as follows:

1. *Earnings*: Income available to common equity divided by beginning of the period market value of common equity:

$$[20_t/(24\times25)_{t-1}],$$

2. *Funds Flow 1*: Income available to common plus depreciation[4] divided by beginning of the period market value of common equity:

$$[(20+14)_t/(24\times25)_{t-1}],$$

3. *Funds Flow 2*: Income available to common plus depreciation and deferred taxes divided by beginning of the period market value of common equity:

$$[(20+14+50)_t/(24\times25)_{t-1}],$$

4. *Cash Flow*: Cash flows generated from continuing operations divided by beginning of the period market value of common equity, where cash flows are defined as income available to common plus depreciation, deferred taxes, and the change in non-cash working capital:

$$[(20+14+50)_t-(4-1-5)_t+(4-1-5)_{t-1}]/[(24\times25)_{t-1}].$$

The definition of the earnings return variable is in agreement with Beaver et al. [1970] so that the resulting beta is conceptually related to the common equity risk of the firm after consideration of its

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[4] "Depreciation" is used throughout the paper to represent non-cash charges for depreciation, amortization, and depletion.

TABLE 1
SUMMARY STATISTICS OF MARKET AND ACCOUNTING BETAS
(1967-1985)

	Unadjusted Beta		Bayesian Adjusted Beta	
	$\bar{X}$	(SD)	$\bar{X}$	(SD)
β: Market Beta	1.118	(.259)	1.108	(.201)
b_1: Earnings Beta	1.000	(.652)	.949	(.457)
b_2: Funds Flow (1) Beta	1.000	(.650)	.951	(.490)
b_3: Funds Flow (2) Beta (deferred taxes included)	1.000	(.636)	.953	(.475)
b_4: Cash Flow Beta	1.000	(.740)	.924	(.472)

$\bar{X}$: Average beta
SD: Cross-sectional standard deviation
n: 272 firms

financing decisions.[5] Although the cash flow variable emphasizes the net cash flow consequences of a firm's continuing operations (expressed as a return on the market value of common equity), it should be noted here that it is, in effect, an estimate of the actual (but unknown) amount. Actual cash flows are virtually impossible to obtain from published reports (see, in particular, Ijiri [1980] and Drtina and Largay [1985]), especially if one is attempting to secure a relatively large sample of firms and the method requires a sufficiently long period.

All of the accounting return variables are deflated by market value. The use of a common deflator provides a basis for the study's focus on the differences in the results due to the extent of the adjustments made to eliminate the accruals in the numerators of the return variables.

Data Source and Sample Selection

The data used are drawn from the COMPUSTAT file for the 1966-1985 period. The screening process required firms to have a complete set of the required monthly and annual data for that period and to have fiscal year ends in December. The screening process resulted in a sample of 272 firms. Specification of the accounting return variables required one-year lagged measures, thus losing one year. The total period examined then relied on 19 years of data (1967-1985). The analyses reported here were also conducted over two sub-periods: 1967-1975 and 1976-1985. Since the results of each sub-period were consistent with those of the combined period, only the combined period results have been reported.

III. EMPIRICAL RESULTS

Table 1 presents descriptive statistics, mean and standard deviation, for the market and accounting betas. With the

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[5] An alternative method to estimate accounting betas as a direct proxy for the market beta is shown in Bowman [1979] and Dhaliwal [1986]. Accounting betas, according to this alternative, are calculated on a before tax and interest basis and then adjusted for taxes and financial leverage.

TABLE 2

RANK (PRODUCT-MOMENT) CORRELATION MATRIX:
MARKET AND ACCOUNTING BETAS

		β	b_1	b_2	b_3
Panel A: Single Securities:					
Earnings Beta	b_1	.205 (.240)			
Funds Flow (1) Beta	b_2	.287 (.334)	.827 (.801)		
Funds Flow (2) Beta (deferred taxes included)	b_3	.280 (.328)	.829 (.803)	.973 (.981)	
Cash Flow Beta	b_4	.305 (.316)	.567 (.541)	.791 (.760)	.804 (.775)
Panel B: Ten-Security Portfolios:					
Earnings Beta	b_1	.658 (.629)			
Funds Flow (1) Beta	b_2	.719 (.759)	.890 (.862)		
Funds Flow (2) Beta (deferred taxes included)	b_3	.700 (.765)	.880 (.871)	.993 (.904)	
Cash Flow Beta	b_4	.762 (.809)	.750 (.767)	.904 (.917)	.894 (.910)

Note: All correlations are significant at $\alpha < .001$.

exception of the cash flow beta for which no published comparisons are available, the measures are similar to those reported in previous studies. As expected, the Bayesian adjustment procedure reduced the variability of the risk measures, particularly accounting betas. As observed in other studies (e.g., Beaver and Manegold [1975] and Baran et al. [1980]), accounting betas have higher cross-sectional standard deviations relative to that of the market beta. This observation is due, in part, to the number of observations (annual vs. monthly) used in obtaining the estimates.

The empirical work in this paper was conducted using both the unadjusted beta estimates and the Bayesian adjusted betas. The two sets of results were found to be quite similar and, thus, we report and discuss the results based on only the Bayesian adjusted betas.

Correlation Results

Table 2 reports the rank and product-moment correlations between the variables examined for individual securities (panel A) and ten-security portfolios (panel B). The following observations, which are in accord with prior findings and/or expectations, can be made.

1. There is a stronger association between market beta and accounting betas at the portfolio level than there is at the single-security level (which may reflect the reduction in measurement errors through aggregation).
2. All correlations are positive in sign and significantly different from zero at less than the .001 level.
3. The relative strength of the associations between the accounting variables is consistent with the extent

TABLE 3
REGRESSIONS OF MARKET BETA ON ACCOUNTING BETAS:
SINGLE-SECURITIES
($n=272$)

Model	*Independent Variables* X(*1*)	X(*2*)	*Coefficients* (*t-statistics*) X(*1*)	X(*2*)	R²	*Sum of Squared Errors*
1	Earnings Beta		.11 (4.1)		.058	10.265
2	Funds Flow (1) Beta		.14 (5.8)		.112	9.677
3	Funds Flow (2) Beta		.14 (5.7)		.107	9.725
4	Cash Flow Beta		.13 (5.5)		.100	9.807
5	Earnings Beta	Funds Flow (1) Beta	−.03 (.80)	.16 (4.1)	.114	9.654
6	Earnings Beta	Funds Flow (2) Beta	−.03 (.66)	.16 (3.9)	.109	9.710
7	Earnings Beta	Cash Flow Beta	.04 (1.4)	.11 (3.8)	.107	9.733
8	Funds Flow (1) Beta	Cash Flow Beta	.09 (2.5)	.06 (1.7)	.121	9.579
9	Funds Flow (2) Beta	Cash Flow Beta	.09 (2.3)	.07 (1.7)	.117	9.620

> of the adjustments made to derive the funds and cash flow specifications. That is, the correlations between earnings and funds flow betas are considerably higher than between the earnings and cash flow betas and the correlations between earnings and funds flow betas are almost as strong as that between the cash flow and funds flow betas.

The cash flow beta had the highest correlation with market risk and the earnings beta had the lowest. Although the funds flows' correlations exhibited intermediate values between those of earnings and cash flows, the difference in their correlations was rather marginal.

Incremental Explanatory Power Test

The question of whether a given variable possesses incremental explanatory power relative to some other variable in explaining market risk is addressed using a set of pairwise regressions. The regressions use market beta as the dependent variable and accounting betas as the independent variables. As previously mentioned, this approach has some features similar to those used by Bowman [1980], Beaver et al. [1982], Beaver and Landsman [1983], and Bublitz et al. [1985].

Tables 3 and 4 report the coefficients, *t*-statistics, coefficients of determination (adjusted R^2), and the sums of squared errors provided from the single and the ten-security portfolio regressions. The results were obtained from two sets of regressions. The first set (models 1 through 4) is based on regressions with a single independent variable. The second set (models 5 through 9) is based on regressions with two independent variables.

The correlation data reported in Table 2 clearly showed collinearity between the accounting risk measures, particularly between earnings and funds flows, and between funds flows and cash flows. Therefore, it is expected that a substantial amount of common explanatory power is present in the variables. To determine the extent of the incremental R^2 of a given variable beyond the common subset, the reduction in the sums of squared

TABLE 4
REGRESSIONS OF MARKET BETA ON ACCOUNTING BETAS:
TEN-SECURITY PORTFOLIOS
($n=272$)

	Independent Variables		*Coefficients* (*t-statistics*)			*Sum of Squared*
Model	X(*1*)	X(*2*)	X(*1*)	X(*2*)	R^2	*Errors*
1	Earnings Beta		.74 (4.0)		.396	.637
2	Funds Flow (1) Beta		.69 (5.8)		.577	.446
3	Funds Flow (2) Beta		.74 (5.9)		.585	.437
4	Cash Flow Beta		.85 (6.9)		.654	.365
5	Earnings Beta	Funds Flow (1) Beta	−.11 (.38)	.77 (3.2)	.579	.443
6	Earnings Beta	Funds Flow (2) Beta	−.18 (.57)	.86 (3.4)	.591	.432
7	Earnings Beta	Cash Flow Beta	.02 (.11)	.84 (4.2)	.654	.364
8	Funds Flow (1) Beta	Cash Flow Beta	.10 (.37)	.75 (2.4)	.656	.363
9	Funds Flow (2) Beta	Cash Flow Beta	.16 (.58)	.69 (2.3)	.659	.360

errors was tested for significance.[6] In particular, the focus was on the *F*-test of the incremental R^2 to determine whether the two-variable regression models significantly improve the R^2 (or equivalently reduce the unexplained variation) of the single-variable regression models [Fogler and Ganapathy, 1982, pp. 54–56; Neter and Wasserman, 1974, pp. 262–265].

Table 5 reports the results of the *F*-tests of the incremental explanatory power (ΔR^2). The data is organized to permit a three-way evaluation process. The first (panel A), is based on the FASB's stance about the primacy of earnings and the contribution of funds and cash flows beyond that already provided by earnings. The second (panel B), draws on Ijiri's [1978] contention as to cash flows being the basic business objective and whether accrual earnings have incremental contribution over cash flows. Third (panels C and D), the tests are expanded to evaluate the relative advantage of a more refined cash flow estimate *vis-a-vis* the simple traditional cash flow proxies (Funds Flow (1) and Funds Flow (2)).

Table 5, panel A, shows a significant increase in explanatory power when each of the funds and cash flow variables is individually added to the regression that has earnings beta as its independent variable. The largest increase was attributable to the cash flow variable at the ten-security portfolio level where R^2 increased by .258. In each case the increase in explanatory power over that provided by earnings was significant at the .01 level or better. By contrast, panel B reveals that there were only minimal consequences to adding earnings beta to the regressions that have funds or cash flow betas as their independent variables. The maximum increase in explanatory power

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[6] Beaver and Landsman [1983], confronted with the collinearity problem, used a two-stage multiple regression approach to test the significance of the added variables' coefficients. However, given the equivalence of alternative multiple regression procedures (see Christie et al. [1984] and Beaver et al. [1984]), and given the nature of the research issues addressed in this paper, we opted for testing the change in the explanatory power directly because it facilitated the presentation of the results.

TABLE 5
INCREMENTAL EXPLANATORY POWER

Base Variable	Added Variable	Regression Models Compared[a]	Single Securities (n=272, DFE=269) ΔR^2	Single Securities (n=272, DFE=269) F-statistic[b]	Ten-Security Portfolios (n=27, DFE=24) ΔR^2	Ten-Security Portfolios (n=27, DFE=24) F-statistic[c]
Panel A						
Earnings Beta	Funds Flow (1) Beta	5-1	.056	17.02***	.183	10.51***
Earnings Beta	Funds Flow (2) Beta	6-1	.051	15.38***	.195	11.39***
Earnings Beta	Cash Flow Beta	7-1	.049	14.70***	.258	18.00***
Panel B						
Funds Flow (1) Beta	Earnings Beta	5-2	.002	.64	.002	.16
Funds Flow (2) Beta	Earnings Beta	6-3	.002	.42	.006	.28
Cash Flow Beta	Earnings Beta	7-4	.007	2.05	.000	.07
Panel C						
Funds Flow (1) Beta	Cash Flow Beta	8-2	.009	2.75*	.079	5.49**
Funds Flow (2) Beta	Cash Flow Beta	9-3	.010	2.94*	.074	5.13**
Panel D						
Cash Flow Beta	Funds Flow (1) Beta	8-4	.021	6.40**	.002	.13
Cash Flow Beta	Funds Flow (2) Beta	9-4	.017	5.23**	.005	.33

DFE = Degrees of freedom for regression error
* Significant at the .10 level
** Significant at the .05 level
*** Significant at the .01 level
[a] See Tables 3 and 4.
[b] Critical values are 6.63, 3.84, and 2.71 for the .01, .05, and .10 significance levels, respectively.
[c] Critical values are 7.82, 4.26, and 2.93 for the .01, .05, and .10 significance levels, respectively.

contributed by earnings beta was a mere .007, for single securities, and in no case was the increase in R^2 significant at a conventional level.

The results of evaluating the relative performance of funds flow betas versus the cash flow betas appear to favor the cash flow betas. The cash flow beta provided significant incremental explanation over each of the funds flow betas for both the single-security and ten-security cases (at the .10 and .05 significance levels, respectively). The funds flow betas significantly increased explanatory power over that of cash flow betas for the single security case, but not for the ten-security portfolios.

IV. SUMMARY AND DISCUSSION

The major purpose of this paper was to assess whether funds and cash flows possess incremental information beyond accrual earnings in the explanation of market risk. The results support the following:

1. The addition of either funds or cash flow-based risk measures signifi-

cantly improves the explanatory power of regression models which use an accrual earnings-based risk measure.

2. While confirming prior findings about the (significant) relation between market beta and earnings beta, our results reveal that the latter measure does not possess incremental explanatory power beyond that provided by either funds or cash flow betas.
3. The results of evaluating funds versus cash flows are consistent across the various combinations in regard to the incremental explanatory power of cash flows over funds flows.

Our findings about the ability of funds and cash flows relative to earnings to explain market risk do not confirm the hypothesis presented in the recent literature (e.g., Gombola and Ketz [1983] and Bowen et al. [1986]) about earnings and the traditional cash flow proxies (i.e., funds flows) having potentially similar information because of their similar statistical properties. We find that the existence of substantial multicollinearity among the variables does not negate the possibility of each providing incremental explanatory power in the presence of the others. Instead, the observed ability of funds flows to provide significant explanatory power beyond earnings is consistent with the view that funds flows contain incremental risk information. Further, the incremental explanatory power of cash flows relative to funds flows is consistent with the hypothesis that the nature of the accrual process that makes it valuable for future cash flow assessment produces numbers that are not as useful for current risk assessment.

The major implication of the results of this study is that, within the confines of explaining market risk, the information in accrual earnings may be largely a subset of the broader set of information included in cash flows. Hence, cash flow data has the potential of supplying additional information on a firm's risk beyond that available from earnings. From this perspective, and given that security prices incorporate investors' assessments of a firm's debt/dividend-paying ability, the findings of this paper lend credence to the theoretical arguments about the importance of cash flows as indicators of some aspects of a firm's performance.

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Rational Economic Behavior and Lobbying on Accounting Issues: Evidence from the Oil and Gas Industry

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ABSTRACT: A substantial accounting research literature seeks to explain the existence of alternative accounting methods and management's willingness to expend efforts lobbying to defend alternate methods. This paper investigates the association between management lobbying on accounting for oil and gas producing activities and the effect that the method may have on firm cash flows and on accounting numbers that are restricted by the terms of firm contracts. Full cost companies that lobbied at different stages of the deliberations on oil and gas accounting are compared with those that did not. The models and their classificatory success rates were statistically significant. Also, the models developed at each stage of the rule-making process provided statistically significant predictions for the other stages. This suggests that the contract and cash flow effects were stable predictors of lobbying by managers.

THE question of why firms choose certain accounting practices has been of interest to accounting researchers and practitioners for some time (see Gordon [1964] for an early study in this area). Recent work suggests that accounting policy choices may be viewed as economic decisions made by managers coincident with investment and production decisions [Zmijewski and Hagerman, 1981]. One approach to increasing our understanding of these accounting policy decisions is the systematic study of the lobbying activities of managers affected by an accounting change [Watts and Zimmerman, 1978]. Watts and Zimmerman suggest that management compensation, information production costs, regulation, taxes, and political costs are factors that influence a manager's decision to lobby on accounting issues. The empirical part of their study surveyed the lobbying positions taken by company representatives who made submissions to the FASB regarding its February 1974 Exposure Draft,

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"Reporting the Effects of General Price-Level Changes in Financial Statements." They interpreted the results of their study as being consistent with their theoretical conjectures.

However, Christenson [1983] questioned Watts and Zimmerman's interpretation of their evidence and can perhaps be interpreted as suggesting that more controlled studies are necessary for furthering our understanding of accounting policy choices. Along these lines, McKee et al. [1984] reevaluated Watts and Zimmerman's data on an extended sample and found less support for the influence of the posited factors on lobbying behavior than reported previously. In addition, the issue studied by Watts and Zimmerman—the FASB's price-level project—was related to supplemental disclosures rather than the primary financial statements that form the reference point for the accounting-based variables that are included in firm contracts and which can affect cash flows. Hence, the question of what factors influence managers when they (1) choose from alternative accounting techniques, and (2) engage in costly lobbying on accounting issues remains open.

A logical avenue for further investigation of the theory would be to test it on an issue that involves primary financial statements and is simple enough that the number of factors that have the potential to influence this decision is small. An issue that allows a focus on contracting cost variables (defined as costs related to debt, management compensation, and regulation) alone avoids certain complications due to possible interactions with tax effect and political consequence variables. Also, an accounting issue that affects the firms in only one industry tends to limit the number of potential confounding effects that can influence the decision to lobby compared to a broader issue which affects firms in several industries.

The lobbying activity by full cost oil and gas companies over several attempts to eliminate the full cost accounting method is an issue that has these characteristics. Since all full cost companies that lobbied favored the full cost method, a test of firm lobbying positions would not be meaningful since their then current method would be a perfect predictor of lobbying position. Instead, the issue investigated is why some firms using the full cost method lobbied and others did not. In essence, the study is a measure of factors which correlate with the intensity of management's perceived importance of its accounting method.

This paper presents the results of developing explanatory models of lobbying behavior of full cost firms at three different stages associated with deliberations on oil and gas accounting. The models are used to predict lobbying on the same events from which the model was developed as well as to cross-predict lobbying on the other two events.

THE OIL AND GAS ACCOUNTING DEBATE AND FACTORS AFFECTING MANAGEMENT ACTION ON SFAS NO. 19

Under the Energy Policy and Conservation Act of 1975, the FASB was delegated the responsibility to develop a uniform accounting method in the oil and gas industry. The FASB issued a Discussion Memorandum (DM) in December 1975. In June 1977, the FASB issued an Exposure Draft (ED) of its proposed standard. In December 1977, the FASB issued SFAS No. 19 which, among other things, eliminated the full cost accounting method that had been used by many industry members [FASB, 1977]. The FASB's decision was appealed to the SEC in March 1978. There were, therefore, three different events which gave rise to lobbying: (1) issuance of the DM; (2) issuance of the ED; and (3) the SEC appeal.

Full cost companies lobbied at all three stages in the rule-making process. Twenty-seven full cost companies lobbied in favor of their method of accounting in response to the DM. Fifty-one lobbied in response to the ED. In the aftermath of the issuance of SFAS No. 19, 50 full cost companies participated in the appeal to the SEC to overturn the FASB standard.

The lobbying companies themselves stated that, the factors that affected their decision to lobby on this issue included: (1) the expected impact on cost of capital and access to capital markets, (2) the potential of the proposed elimination of the full cost method to affect accounting income-based management incentive contracts, (3) the perceived effect on future drilling activity, and (4) the effect on rate-regulation [U.S. Securities and Exchange Commission, 1978].

Previous discussions of management lobbying behavior suggest that management will lobby if the expected benefits of lobbying exceed the costs of lobbying [Kelly, 1983]. Lobbying is always costly since, among other costs, it requires the use of management time to appear before rule-making bodies or to prepare statements for such rule-making bodies. Consequently, lobbying will only occur if management believes that it can affect the probability that a rule will be enacted or repealed.[1] For the issue investigated in this paper, the benefits from lobbying arise in the form of the avoidance of costs associated with the mandated change in accounting method.

Following the earlier studies on accounting method choice and lobbying behavior, this study assumes that for analytical purposes the cost of lobbying is fixed, but that the benefits from lobbying will vary across firms. Firms that would incur high costs because of the mandated accounting change are more likely to lobby than firms that would incur only small costs. The costs examined here are those related to management incentive plans, debt contracts, regulation, and the level of oil and gas exploration expenditures by a company. For reasons discussed below, the influences of taxes, political costs, and ownership control that have been suggested as important in other contexts do not seem important here.

Historically, income taxes for oil and gas exploration activity (as well as for other natural resources) are computed on a different basis than these fundamental financial accounting rules. Hence, the proposed accounting change would have no direct tax consequences. Moreover, full cost companies tend to be the smaller producers and smaller companies have traditionally received preferential tax treatment.[2] Therefore, the affected subset will tend not to experience adverse tax consequences as a result of their use of the full cost method.

[1] Alternatively, management may believe it can cause a modification to the rule that will reduce the adverse effects. The analysis of management's incentives under this scenario is the same. Note that it is assumed here that the full cost issue is not one for which firms would perceive it to their advantage to misrepresent their true feelings. The income and equity effects from the elimination of full cost were probably too large for managers to consider long run strategic issues. See Amershi et al. [1982] for elaboration on strategic considerations in the lobbying context.

[2] For example, smaller companies are permitted to deduct intangible drilling costs as incurred [Internal Revenue Code Section 291]. Larger companies must capitalize these costs. Certain smaller companies may still use statutory depletion, that is not available to larger companies [Internal Revenue Code Section 613A]. Smaller companies were subject to preferential tax rates under the Windfall Profit Tax Act of 1980 [Internal Revenue Code Section 4988]. Smaller companies are entitled to certain exemptions under that Act that are not available to larger companies [Code Section 4994]. The royalty owner's exemption is also limited to smaller companies [Code Section 643].

The structure of the oil and gas industry tends to shield full cost companies from the types of political pressures faced by the major companies. The industry is generally considered to consist of 20 to 24 "major" companies [Deakin and Porter, 1978] as well as a number of smaller "independent" companies. Major companies are traditionally singled out for legislative action.[3]

Only three of the majors employ the full cost accounting method. Two of these companies have most of their exploration activities located outside of the U.S. and the remaining one is predominantly an interstate pipeline company whose exploration accounting is prescribed by Federal Power Commission Order 440-A requiring full cost accounting. Thus, the political cost factor is not perceived relevant to the lobbying decisions of firms for the accounting issue examined in this paper.

The level of management ownership has been suggested as a variable that may be associated with the lobbying positions taken by firms [Kelly, 1983]. However, Deakin [1980] showed that full cost companies tend to have low levels of management ownership. Thus, this variable's effect is minimized in this industry subset.

MEASUREMENT ISSUES AND VARIABLE DEFINITIONS

In an empirical test on lobbying activity data cannot be obtained directly about the expected benefits of lobbying because the factors that are considered in making these decisions are private. Hence, it is necessary to find operational measures of unobservable motivating factors. As noted above, the four identified factors believed significant in this accounting context are: (1) debt covenant costs, (2) management incentive compensation effects, (3) the size of operations subject to the accounting change, and (4) regulation. A discussion of the operational measures of each factor follows.

Debt Covenant Costs

Earlier studies suggest that the impact of an accounting change on capital costs (including access to capital markets) is related to the existence of loan agreements that impose restrictions on management's actions if certain variables denominated in terms of accounting constructs breach specified limits. If the loan agreements for full cost companies contain restrictions in terms of a net income or equity number, then the proposed accounting standard, because it reduces net income or equity, could bring the company closer to violation of its contractual constraints [Leftwich, 1981]. Companies that have higher debt relative to equity are assumed to be closer to the limits imposed by such loan agreements. Hence, the relative debt-equity position of a company within its industry is assumed correlated with the capital cost factor.

It has been suggested [Dhaliwal, 1980; Holthausen, 1981; and Leftwich, 1981] that renegotiation of debt covenants is more costly for public debt than for privately held debt. The change in contract terms because of the change in accounting may be waived by a private lender.

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[3] The Energy Policy and Conservation Act of 1975 provided that an energy data base be developed using accounting information on the largest companies. At the time, Congressional hearings were begun that sought to require divestiture of integrated oil company operations. This divestiture would only have affected the larger companies. The Tax Act of 1984 that repealed certain benefits of the foreign tax credit was aimed at larger integrated oil producers. Recently, larger producers have been subject to adverse tax effects related to foreign intangible drilling costs [1986 Tax Act]. As noted in footnote 2 above, larger integrated producers have also been subject to differential tax treatment.

However, the trustee of a public debt issue may be under greater pressure to uphold the contract terms even though they are based on an accounting rule that was changed in a manner beyond the control of or unforeseen by either the debtor or creditor. At the time this accounting rule was in process, interest costs were rising dramatically. Lenders, therefore, had an incentive to force renegotiation when possible in order to obtain higher interest rates as part of the agreement to waive contract violations. This fact would tend to increase the cost of all debt subject to renegotiation. Publicly held debt, however, would be more likely to be subject to such renegotiation because the trustees would be under more pressure to force renegotiation to obtain the higher rates.

The impact of debt covenant effects on the cost of and access to capital may be viewed as a function of (1) the existence of debt covenants based on equity or income numbers,[4] (2) the closeness of the company to its debt limits as reflected by its relative debt/equity ratio, and (3) whether the company's debt is publicly or privately held. Although a direct computation of these costs for the affected companies is not possible, it is reasonable to assume that the capital costs associated with an accounting method change will rise with the presence of these factors. The more of these factors present, the more likely a company would be to incur costs and, by extension, the greater would be the expected value of such costs.

The capital cost effect is measured by a variable which reflects the existence of accounting-based debt limits, higher than average debt ratios, and the existence of public debt. A value of one was assigned for each factor present, with a "capital cost" score ranging from a possible value of zero (no accounting-based restrictions, below average debt, no public debt) to a value of three (all these elements present). Thus, we assume that the capital cost factor will be positively correlated with the presence of each of these items. The use of such a "scoring" rule to construct a variable combines the factors believed to affect capital costs into a single variable. Since the scoring rule is *ad hoc*, several alternative approaches were tried, including the use of each variable as independent predictors. The results were not sensitive to alternative formulations.[5]

Management Incentive Compensation

The sensitivity of management to accounting income numbers may be enhanced if management's compensation is, at least in part, based on an incentive compensation plan that is based on accounting income. Jensen and Meckling [1976] suggest it may be in management's interest to increase accounting income through bookkeeping techniques that do not require extensive management effort.

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[4] Although it may be argued that companies with no accounting-based numbers in their debt contracts would not experience increased debt-related costs, the change in accounting method could affect even those companies by making it more costly for them to raise capital in the future. This point was addressed during the U.S. Securities and Exchange Commission hearings in 1978.

[5] Alternative models included one where each of the debt-covenant related variables was entered separately or in combinations. For the DM model, the classification success changed by three observations across different constructs of this variable. The debt index was one observation worse than the best model (debt/equity) and one observation better than the worst model (debt/equity plus bond covenants). For the ED, the range of correct predictions also varied by three. The debt index model was one better than the worst models (debt/equity alone and bond covenants alone) and one worse than the best model (public debt alone). For the SEC appeal, there was a range of five observations between the best and worst model. Debt/equity taken alone performed worst, and misclassified three more observations than the debt index. The model that included all three as separate predictors performed best, and predicted one more observation correctly than did the debt index. The debt index was the most consistent predictor across all events, even though it was neither the best nor worst for any one event.

In this study, an indicator variable is used to represent whether a company has a management incentive plan based on accounting income. This representation assumes that the presence of such a plan will tend to induce management to lobby. Such an inducement would arise if the mandated accounting change directly reduced income and, hence, compensation. Sufficient data about the terms of the compensation plans in this industry were not available to enable computation of the effect for each firm with an accounting-based plan. As a result, it was not possible to refine this variable further to include only firms where the accounting change would reduce management's compensation. Therefore, this study relies on a dichotomous variable to represent the effect of incentive compensation and it is assumed that management of firms with such plans will, in general, be more likely to lobby.[6]

Company proxy statements, 10-K filings, and registration statements contain some information on these incentive contracts. These documents were examined for the affected companies. If the description of the plan indicated that profit, income, or a similar basis was used for setting incentive compensation, it was assumed that such a plan would make management more likely to lobby for preservation of the full cost method. If there was no plan or if the plan description made no mention of accounting income, then management was assumed less likely to lobby on the issue.[7]

Level of Oil and Gas Investment

The costs associated with an accounting change are expected to depend upon the dollar amount of a company's activity subject to the accounting change due to the impact of such a change on existing contracts. Thus, this factor may be an interactive one that affects the impact of the contract variables. However, it may also capture elements not present in contracts since, *ceteris paribus*, we expect companies subject to a greater financial statement impact to be more likely to lobby.

Sunder [1976] demonstrates that the effect of the accounting change examined here is correlated with the level of a company's investment in oil and gas exploration. Dollar expenditures for oil and gas exploration are available due to industry disclosure requirements under SFAS No. 19 and SEC regulations. The amount of a company's exploration expenditures for the year closest to each lobbying event was used to proxy for the amount of investment in oil and gas exploration.[8]

Overall firm-size has been suggested as important in management's decision to lobby on an accounting issue. Reasons given for the importance of this factor include the extent to which size proxies for political costs, the extent to which size reflects the costs that a firm will incur as a result of an accounting change, and the belief that larger firms are better able to afford to lobby. Since political costs are believed not important in this context for this sample, the size effect would arise from either the cost of the change proxy or the ability of the firm to afford the cost of lobbying. Since the accounting change is associated with a company's oil and gas activities, those expenditures would seem to provide a more direct measure of the cost of the accounting change than would overall size. Hence, the more direct measure of the effect of the accounting change is used in this paper.[9]

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[6] The 12 plans for which such information was available all indicated a decrease in management compensation with the accounting change.

[7] It is, of course, possible that some plans are profit-based, but that fact was not a part of the disclosures on the plan. However, if the factor were not important enough to mention in the disclosure, it may be that management is not as sensitive to it compared with companies that do mention the accounting income component of their plans.

[8] Alternative choices for the second variable included the impact of SFAS No. 19 on capital or on income. In part, this choice was rejected because it could be correlated with the debt covenant factor where these covenants are based on maintenance of certain capital or income levels. However, a test of models that included these effects obtained the same outcome with respect to levels of significance and predictive ability to those reported here, although the absolute numbers were different.

Regulatory Effect

In the oil and gas industry, public utilities that distribute natural gas are subject to earnings regulation by state public utility rate-making authorities. Most of these authorities require full cost accounting rules for rate-making purposes. Interstate pipelines and natural gas producers subject to Federal Power Commission rules are also subject to earnings regulation based on full cost accounting. Changes in the accounting rules would at least require additional bookkeeping costs and could result in changes in the regulatory accounting bases. Either event is likely to be costly. Kelly [1983] noted the importance of this factor as did many of the companies that lobbied for full cost accounting. Because regulated companies are usually subject to a "fair" return on assets, the interaction between regulation and accounting for oil and gas is difficult to ascertain. Full cost accounting increases the asset base for rate-making purposes. Since allowed rates of return are a function of the asset base, regulated companies tend to prefer full cost accounting.[10]

An indicator variable was used to represent whether a company was or was not subject to rate regulation. The value assigned to this variable for regulated pipelines or natural gas companies was one while for all other companies the variable was zero.

Thus, four variables were constructed for each of the companies in the full cost sample. These variables were used to represent capital costs, managements' incentive compensation factor, the financial statement effect, and the regulatory effect. Each variable is expected to be positively correlated with lobbying.

SAMPLE SELECTION AND DESCRIPTION OF MODEL

The starting point for defining the sample was the FASB's list of 137 U.S. full cost companies. The FASB believed this list contained the total population of publicly listed full cost firms in 1978 [SEC File 7-715, SEC, 1978]. According to the SEC public hearing agenda, 50 of these firms lobbied before the SEC while the remaining 87 did not. According to the FASB's Public File, 51 of the companies lobbied in response to the ED and 86 did not. Information on all of the variables included in this study were available for 118 companies, in total. These included the companies that lobbied on either the ED or before the SEC.

The DM was issued two years prior to the other events, so the FASB's list of full cost firms was reduced by eliminating those who, according to Moody's, were not publicly listed (or, possibly not in business) at that time or who, according to their annual reports, were not engaged in oil and gas operations at that time. This resulted in a sample of 94 companies for the DM analysis of which 27 lobbied and 67 did not.

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[9] Use of overall firm-size and the proportion of the firm's assets invested in oil and gas activities resulted in statistically insignificant differences in the results (changes occurred in the fourth digit of the model probability level). No classification changes occurred with the use of these two variables. Use of firm-size alone resulted in one less correctly classified case in the ED sample and no other classification changes in the other events. Model statistics were insignificantly different.

[10] See Arthur Andersen [1983, p. S-17] that indicates that 72 percent of regulated companies use full cost accounting. Also note, Jarrell [1979] finds that there may be a proproducer bias in the decisions of regulators. The required use of the FC method would, thus, be consistent with the view that the FC method is beneficial to regulated firms.

Financial data were obtained from 10-K filings and annual reports. Information concerning public debt and debt agreements were obtained from corporate report discussions, registration statements, and Moody's manuals. Data on management incentive compensation plans were obtained primarily from company proxy statements.

Data for 1976 were used for the DM analysis since the responses were made that year. Data for 1978 were used for the ED and SEC lobbying models. A univariate statistical summary of these data is presented in Table 1 for each event: DM, ED, and SEC lobbying. The debt index data are based on the means of the constructed index. Table 1 reveals that the means for each of the variables fall in the direction suggested by the hypotheses (e.g., the lobbying group contains a higher proportion of regulated firms than does the non-lobbying group). However, univariate tests of the differences between the means for lobbying firms versus non-lobbying firms are not statistically significant.

The data for this study were entered into three logistic regression models of the form:

$$L=\beta_0+\beta_1 DBT+\beta_2 MIC+\beta_3 OGEXP+\beta_4 REG$$

where

L = lobbying (1) or not lobbying (0),
DBT = debt index (one point for each indicator of a debt contract cost from SFAS No. 19),
MIC = incentive bonus based on net income (1) or not (0),
$OGEXP$ = expenditures on oil and gas activities in the current year, and
REG = regulated (1) or nonregulated (0) company.

A model was estimated for each lobbying event: (1) the DM, (2) the ED, and (3) the SEC appeal. The models were used to classify lobbying and non-lobbying companies for each event. To test model stability, each model was used to classify companies with respect to their participation in the other two lobbying events.

ANALYSIS OF RESULTS

Since the sample consisted of both regulated and nonregulated firms, it is possible that regulated firms could be subject to a different set of considerations than nonregulated firms. Consequently, a separate analysis of the unregulated firms in the sample was conducted. The results for the unregulated sample were so similar to those for the full sample that only the full sample results are reported here.

Logistic Model Results

A logistic regression function was fitted to the data for each of the three events. Results of the three regressions are shown in Table 2. The overall fit of the model is similar for all three events. Consequently, we discuss only the overall fit of the model to the DM event.

The deviance statistic for the DM model was 57.56. This statistic represents the sum of the squared residuals from the model and is distributed as an χ^2 random variable. The greater the deviance relative to its degrees of freedom, the less the model fits the data. In the DM case, there were 88 degrees of freedom. Since

TABLE 1

SUMMARY UNIVARIATE STATISTICS ON LOBBYING AT THREE STAGES OF THE DELIBERATIONS

Panel A. Discussion Memorandum Lobbying (27 lobbying firms and 67 non-lobbying firms):

	Regulated Firm (REG)[1]	*Management Incentive Contract* (MIC)	*Debt Index* (DBT)	*1976 E&P Expenditures ($ millions)* (OGEXP)
Means:				
Lobbying	.37	.53	1.11	67.74
Non-Lobbying	.23	.25	.93	15.09
Standard Deviations:				
Lobbying	.48	.49	.68	98.21
Non-Lobbying	.42	.43	.80	32.51

Panel B. Exposure Draft Lobbying (51 lobbying firms and 67 non-lobbying firms):

	Regulated Firm (REG)	*Management Incentive Contract* (MIC)	*Debt Index* (DBT)	*1978 E&P Expenditures ($ millions)* (OGEXP)
Means:				
Lobbying	.43	.46	1.22	48.06
Non-Lobbying	.11	.25	.75	8.01
Standard Deviations:				
Lobbying	.49	.49	.69	80.89
Non-Lobbying	.31	.43	.78	15.28

Panel C. SEC Appeal Lobbying (50 lobbying firms and 68 non-lobbying firms):

	Regulated Firm (REG)	*Management Incentive Contract* (MIC)	*Debt Index* (DBT)	*1978 E&P Expenditures ($ millions)* (OGEXP)
Means:				
Lobbying	.35	.57	1.30	39.45
Non-Lobbying	.19	.16	.71	17.60
Standard Deviations:				
Lobbying	.48	.49	.70	45.91
Non-Lobbying	.39	.36	.75	42.13

[1] *REG* and *MIC* represent the proportion of firms in each group that are regulated or have management incentive plans based on accounting income, respectively. *DBT* and *OGEXP* means represent the arithmetic mean of these two measures for members of the lobbying and non-lobbying groups, respectively.

$p(\chi^2_{88}<57.56)$ is .999, the hypothesis that the model fits the data is accepted. The statistic *R#*, described in McKee et al. [1984] is .599. This is a measure equivalent to an *R*-squared from an ordinary least squares regression and reflects the fit of the model.

Table 2 reveals that the signs of the individual coefficients for all three events are all positive, which is in the direction

TABLE 2

LOGISTIC REGRESSION RESULTS FOR LOBBYING

$$L=\beta_0+\beta_1 DBT+\beta_2 MIC+\beta_3 OGEXP+\beta_4 REG^1$$

	Regulated Firm (REG)	*Management Incentive Contract* (MIC)	*Debt Index* (DBT)	*1978 E&P Expenditures ($ millions)* (OGEXP)
Panel A. Discussion Memorandum Model ($n=94$):				
Coefficients	.494	.542	.051	.022
t-statistics	.871	2.186**	1.531	2.486**
Deviance 57.56				
$p(x^2)$ .9950				
R# .599				
Panel B. Exposure Draft Model ($n=118$):				
Coefficients	.389	.256	1.469	.040
t-statistics	.776	1.450	2.792**	3.646**
Deviance 70.47				
$p(x^2)$ .9995				
R# .659				
Panel C. SEC Appeal Model ($n=118$):				
Coefficients	2.088	.574	.986	.001
t-statistics	4.181**	2.031**	1.870*	.441
Deviance 67.99				
$p(x^2)$ .9999				
R# .645				

* Significant at the .05 level.
** Significant at the .01 level.
[1] L=Lobbying (1) or not lobbying (0)
DBT=Debt index (one point for each indicator of a debt contract cost from SFAS No. 19)
MIC=Incentive bonus based on net income (1) or not (0)
$OGEXP$=Expenditures on oil and gas activities in the current year
REG=Regulated (1) or nonregulated (0) company

predicted by the discussion earlier in the paper. However, the significance of individual regression coefficients changed somewhat from event to event. The coefficients of *MIC*, *DBT*, and *OGEXP* are significant for two of the three events. The changing significance levels of the coefficients suggests possible instability of the models across the events. Correlations of the independent variables were computed for the DM and the ED (and the SEC) events to see if significant multicollinearity was present.[11] These are reproduced in Table 3. The management

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[11] The ED and SEC events have identical correlation matrices because the independent variables for these two events are identical.

TABLE 3

CORRELATION MATRICES FOR EXPLANATORY VARIABLES

Discussion Memorandum Sample ($n=94$):

	Regulated Firm (REG)	*Management Incentive Contract* (MIC)	*Debt Index* (DBT)	*1976 E&P Expenditures ($ millions)* (OGEXP)
REG[1]	1.000			
MIC	−.063	1.000		
DBT	.295*	.242*	1.000	
OGEXP	.085	.279*	.229*	1.00

Exposure Draft and SEC Appeal Samples ($n=118$):

	Regulated Firm (REG)	*Management Incentive Contract* (MIC)	*Debt Index* (DBT)	*1978 E&P Expenditures ($ millions)* (OGEXP)
REG	1.000			
MIC	−.027	1.000		
DBT	.147	.164	1.000	
OGEXP	−.087	.229*	.068	1.000

* Significant at the .05 level.

[1] See Table 1 for definitions.

incentive compensation variable was correlated with the debt and size variables in the DM sample, although the correlation coefficients were less than .30, they were individually statistically significant.

Similarly, the management incentive compensation variable was correlated with the size variable in the ED and SEC sample. Thus, these correlations could affect the stability of the estimated coefficients. However, the overall significance and the predictive ability of the models are not affected. As seen below, the models were consistently better than chance at classifying lobbying behavior across events. Taken as a whole, then, the models appear to be stable predictors of the firms' decisions to lobby on this issue. Therefore, the further discussion of the model is directed toward the model taken as a whole and not toward specific predictor variables.

Same Event Classification Accuracy

The predictive ability of the models were first tested by examining the success of each model in classifying the lobbying decisions for the same event used to derive the model. The tests used a jackknifing procedure that was based on the work of Lachenbruch and Mickey [1968]. Results are shown in Table 4.

Two classification criteria are used to test the predictive ability of the models [Morrison, 1969]. One is based upon the overall classification success of the model while the second is based upon proportional group classification success.

The C_{max} criterion compares the model's overall success rate to the success rate that would be obtained if every member of the group were classified as a member of the larger group in the population. For the DM sample, the

TABLE 4
LOBBYING CLASSIFICATION RATES
HOLDOUT SAMPLE METHOD
(t-STATISTICS)

Model	*Chance Criterion*	*Proportion Correct* *Overall*	*Proportion Correct* *Lobbying Group*
Discussion Memorandum	.713	.798 (1.82)*	.778 (5.23)**
Exposure Draft	.597	.822 (5.32)**	.647 (2.94)**
SEC Appeal	.568	.763 (4.21)**	.735 (4.91)**

* Significant at the .05 level.
** Significant at the .01 level.

non-lobbying group comprised 67 firms or .713 of the population. Table 4 reveals that the model correctly classified .798 of the overall population (75 of 94 firms) for the DM event. This is significantly better (at the .05 level) than classifying all of the firms as non-lobbying. The test is a Z-statistic constructed using the C_{max} criterion where:

$$C_{max}=\text{Max}(a,\ 1-a)$$

and a is the proportion of the sample in the non-lobbying group. In this instance, $a=.713$ and $1-a=.287$. The proportion of the sample correctly classified is compared to C_{max}. For these data, the resulting Z-statistic (Z_{max}) is computed as:

$$Z_{max}=\frac{.798-.713}{\sqrt{\frac{.713\times.287}{94}}}=1.82$$

which is significant at the .05 level.

Table 4 shows that the Z_{max}-statistics for the ED and SEC events were 5.32 and 4.21, respectively. Both are significant at the .01 level. Thus, all three models performed significantly better than chance at classifying company's lobbying activities using the criterion of overall classificatory success.

The second criterion, the proportional classification test, examines the model's success at predicting proportional group membership. Morrison [1969] suggests that this is the more important test when there are differences in the proportions of group membership.

The classificatory test statistic for measuring success at identifying proportional group membership is based on the sum of the squared proportions in each group and is referred to as Z_{pro}. Here the chance criterion (C_{pro}) is based on the squares of the proportions of the observations in each group [Morrison, 1969, p. 158]. In this study, the value of Z_{pro} for the DM model is computed as:

$$Z_{pro}=\frac{.778-.591}{\sqrt{\frac{.591\times.409}{94}}}=3.70$$

where $.591=.713^2+(1-.713)^2$ is the proportional chance criterion. The proportion of the smaller group that has been

TABLE 5
LOBBYING CROSS-PREDICTION RESULTS
(t-STATISTICS)

Model Used	*Event Predicted*	*Proportion Correct* *Overall*	 *Lobbying Group*
Discussion Memorandum:	Exposure Draft	.720 (3.14)*	.769 (5.59)*
	SEC Appeal	.763 (4.04)*	.807 (6.47)*
Exposure Draft:	Discussion Memorandum	.830 (2.51)*	.745 (3.05)*
	SEC Appeal	.788 (4.76)*	.694 (4.02)*
SEC Appeal:	Discussion Memorandum	.840 (2.73)*	.889 (5.88)*
	Exposure Draft	.711 (2.96)*	.700 (4.09)*

* Significant at the .01 level.

correctly classified .778, is given in the last column of Table 4. The resulting Z_{pro} value represents a standardized difference between the actual classification success rate and the rate expected by chance and is significant at the .01 level.[12] Similar significance results were obtained for the ED model and the SEC model, with a Z_{pro}-statistic of 2.94 for the ED and 4.91 for the SEC, respectively. These statistics are all significant at the .01 level.

Cross Event Prediction Results

Since each model was based on a presumed association between identified factors and lobbying, the model derived from one lobbying event should be useful for predicting whether a company would lobby on another phase of the process. Use of the data from one event to predict another tends to reduce the problem of overfitting that occurs when the same data used to generate the model are also used to test predictions. Successful cross-predicting also provides further evidence on the stability of the models. Accordingly, the model estimated from each event was used to predict whether a company would lobby on each of the other two events in the process.

As shown in Table 5, all six models were significant using both of Morrison's criteria. That is, the model derived from the comparison of companies that lobbied and did not lobby on the DM was used to classify firms with respect to the ED and SEC events. Z_{max}-statistics of 3.14 and 4.04 were obtained for the ED and SEC events, respectively. These statistics indicate that the DM model performed better than chance for overall classification. Z_{pro}-statistics of 5.59 and 6.47 were obtained for the ED and SEC events, respectively. This indicates that the model fitted to the data for the DM event is better able to predict the activities of the lobbying group during the SEC and ED events than chance.

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[12] Other references on classification statistics suggest use of log linear models. Results from using log linear classification models were consistently significant at the .01 level.

The model developed from lobbying on the ED was used to classify firms on the DM and SEC events. The results indicate that the model performed better than chance. The model fitted to the ED data produced Z_{max}-statistics of 2.51 and 4.76 for the DM and SEC events, respectively, and are significant at the .01 level. Z_{pro}-statistics of 3.05 and 4.02 were obtained for the DM and SEC events, respectively. Finally, the SEC model was used to classify firms that lobbied on the DM and ED. The Z_{max}-statistics were 2.73 and 2.96 while the Z_{pro}-statistics were 5.88 and 4.09. These results indicate that the SEC model was significantly better than chance at correctly classifying the lobbying behavior of firms for the DM and ED events.

These results suggest that the models perform significantly better than chance for predicting which firms were likely to lobby on this accounting issue. Although the coefficients for individual variables are not all consistently significant, the logit models are consistently significant overall. Moreover, the classification models are consistently better able than chance to predict lobbying on other, related events. Thus, the models are stable predictors overall. This supports the hypothesis that debt covenant, management compensation, regulatory, and financial statement effect costs are positively associated with the lobbying activity carried on by full cost firms in the oil and gas industry.

CONCLUDING REMARKS

The decision to lobby on accounting rules is hypothesized to be made on the basis of the economic effects of the rules on a firm or on its management as perceived by management. In particular, the impact of accounting numbers on contractual arrangements is the means by which accounting methods can affect the economic well-being of the firm and its managers. This paper provides evidence that supports this hypothesis.

The lobbying program carried out by oil and gas firms involved a series of events. Because the issue affected a specific industry and because the direction of the effect associated with the issue on income and equity was almost uniformly the same, the relation between factors that may be associated with the decision to lobby and the actual decision could be specified more clearly and with greater confidence than has been possible in previous studies on more general accounting controversies. The results of this study are consistent with the hypotheses proposed in the positive-theory literature. This may be attributable to the specific context of the debate or to the greater clarity offered by the context. At this point, it is not possible to distinguish between the alternate explanations.

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SMALL SAMPLE STUDIES

M. Edgar Barrett, Editor

The Year-End LIFO Purchase Decision: The Case of Farmer Brothers Company

Robert M. Bowen and Glenn M. Pfeiffer

ABSTRACT: Companies that use commodities as inputs (e.g., crude oil and coffee) often face inventory decisions in an environment of widely fluctuating prices. Under LIFO, the end-of-period decision to replace liquidated LIFO layers (or not) may dramatically affect cost of goods sold for both tax and financial reporting. In this paper, we first model the factors involved in the end-of-period decision to acquire inventory. We then apply this model in the context of the difficult situation faced by the management of the Farmer Brothers (coffee) Company in fiscal year 1977. The events reflected in Farmers Brothers' fiscal year 1977 financial statements reveal many of the economic factors involved in managing inventories recorded on a LIFO basis. The actual end-of-period decision reached by Company management is compared to plausible alternative actions. The analysis focuses on estimates of the effects of these alternative actions on cash flows and reported income as well as other factors that might have influenced management to increase the level of ending inventory in the face of declining prices.

THE economics of inventory management decisions continue to generate interest in the popular and academic business media (e.g., see Biddle and Martin [1985], Biddle [1981], Cottell [1986], and Granof and Short [1984]). At the end of each annual accounting period, managers of companies that use the last in, first out (LIFO) method of inventory valuation are faced with the potentially complex decision of setting the level of ending inventory. This year-end decision to purchase inventories (or not) affects the period's cost of goods

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sold for both tax and financial reporting purposes.[1] As discussed in the literature, an optimal decision involves tradeoffs among numerous economic factors including: expected demand, the current level of inventory on hand, projected price changes, tax implications (as a function of current and projected tax rates and laws), fixed and variable ordering costs, the risk of obsolescence and stock-outs, warehousing and insurance costs, and the cost of capital.[2] In addition, since year-end purchases have an immediate effect on income and asset values, this decision may also be influenced by the use of financial accounting numbers in contractual agreements, such as loan indentures and employee incentive plans. Because the financial reporting effects of LIFO usually run opposite the cash flow effects, managers may face conflicting objectives when making this decision.

Cottell [1986] reports that in excess of 80 percent of the companies surveyed indicated that the decision to liquidate LIFO inventory layers was made at the top management level or higher. Respondents stated that federal income taxes and inventory carrying costs were the most important factors in their decision to maintain, liquidate, or increase the level of LIFO inventories. The year-end decision is especially difficult for managers of firms with continuously fluctuating input prices. This includes firms that deal in commodities such as oil or coffee as well as firms that purchase inputs from foreign sources and must, therefore, deal with fluctuating exchange rates.

In this paper, we first create a two-period model of the cash flow effects of replacing LIFO layers at year-end. We next consider the impact of the year-end purchase decision on financial reporting and contracts based on accounting numbers. We then illustrate the factors involved in the choice of year-end inventory levels in the context of the situation faced by the management of Farmer Brothers (coffee) Company in fiscal year 1977. The events reflected in this company's 1977 financial statements reveal many of the economic factors involved in managing inventories recorded on a LIFO basis—especially for companies dependent on commodity prices. The 1975 Brazilian freeze reduced coffee supplies and resulted in a particularly wide swing in prices. The effect on Farmer Brothers Company illustrates: (1) the tradeoffs involved in replenishing liquidated LIFO layers when future prices are expected to be lower than current end-of-period prices, and (2) the effects of this year-end decision on financial reporting. The fact that this is an ongoing issue for management is reflected in recent and continued fluctuations in coffee prices.[3]

The generalizability of the Farmer Brothers example to other situations is partially based on the extent to which input price volatility is a common issue facing managers. In Table 1, we present data on price volatility across 12 commodities by computing the ratio of the range in monthly prices (high minus low) to the low price for each commodity. The table reports the volatility index for each commodity (including coffee) for the seven years from 1978 through 1984.[4]

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[1] Year-end decisions by managers of firms using other methods of inventory valuation (e.g., FIFO or average cost) do not face the same tax versus financial reporting trade-offs and are not considered in this paper.

[2] See Biddle and Martin [1985], Cohen and Halperin [1980], and Davis et al. [1984] for a discussion of these factors.

[3] See Valentine [1985; 1986] and Valentine and Wall [1986]. Among commodities, coffee is second only to crude oil in trading volume.

[4] Data was not consistently available for some commodities (including coffee) prior to 1978. However,

TABLE 1
COMPARISON OF PRICE VOLATILITY ACROSS COMMODITIES
INDEX OF PRICE VOLATILITY BY YEAR (RANGE OF MONTHLY CLOSING PRICES/LOW PRICE)

Commodity	*1978*	*1979*	*1980*	*1981*	*1982*	*1983*	*1984*	*Mean**
Aluminum	0.42	0.57	0.62	0.34	0.41	1.31	0.67	0.62
Coal	0.11	0.03	0.03	0.08	0.05	0.02	0.02	0.05
Coffee	0.77	0.33	0.41	0.69	0.62	0.24	0.26	0.47
Copper	0.15	0.48	0.50	0.10	0.13	0.24	0.20	0.26
Crude Oil	0.08	0.51	0.34	0.33	0.10	0.07	0.04	0.21
Lumber	0.21	0.62	0.13	0.32	0.07	0.49	0.23	0.30
Meat	0.30	0.28	0.13	0.14	0.24	0.18	0.14	0.20
Paper	0.06	0.16	0.11	0.05	0.08	0.04	0.08	0.08
Plastic	0.08	0.35	0.10	0.14	0.34	0.36	0.08	0.21
Rubber	0.35	0.39	0.27	0.60	0.17	0.45	0.39	0.37
Sugar	0.32	0.30	1.32	0.96	0.32	0.08	0.05	0.48
Tea	0.15	0.13	0.07	0.10	0.11	0.46	0.29	0.19

Source: *Commodity Yearbook*, various pages.
* Mean volatility index for seven years, 1978–1984.

Coffee exhibited the third largest individual and average within-year price swings, following aluminum and sugar. In addition, the data indicate that seven of 12 commodities had at least one year where the price volatility index equalled or exceeded 50 percent. We interpret these data to indicate that the price environment for coffee is representative of the environment facing companies that use commodities other than coffee as inputs. More generally, managers of LIFO firms that purchase any type of input that tends to fluctuate widely in price are faced with situations similar to that illustrated here.

The paper is organized as follows. In Section I, we present a model of the cash flow effects of the end-of-period purchase decision. In Section II, we introduce the circumstances surrounding fiscal year 1977 operations for the Farmer Brothers Company. In Section III, we use the model to estimate the specific effects of alternative purchase decisions on Company cash flows and reported profits and, in Section IV, we consider factors not specifically included in the model that may affect the decision. Finally, in Section V, we summarize the analysis and evaluate the factors that potentially affected management's actual decision. Despite declining coffee prices, management chose to replace seven million pounds of coffee liquidated earlier in the fiscal year and further increase inventory by 1.9 million pounds. The decision is consistent with predictions of the model specified in Section I. Although one case cannot validate a model, the study suggests an approach that may be used with larger samples to explain the year-end inventory purchase decision.[5]

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available observations from the period 1973 through 1977 reveal individual yearly price fluctuations far exceeding those reported in Table 1, including a volatility index of 4.05 for sugar in 1974.

[5] A difficulty with gathering a larger sample is that single line of business companies are unusual. For example, Farmer Brothers is the only publicly traded company that we could identify that is almost exclusively involved in the production of coffee.

I. A MODEL OF THE END-OF-YEAR PURCHASE DECISION

Toward the end of each accounting period, management faces a number of options regarding inventory levels. In this section we examine the alternatives available at the end of each fiscal year. We limit our analysis by accepting as given the beginning-of-year inventory level and management's demand forecast for the coming year. We also assume that management prefers to continue using LIFO to value inventories.[6] Under LIFO, management's decision to liquidate, maintain, or increase inventories relative to beginning-of-year levels affects both financial reporting and taxable income for that year. Further, the effects of this decision depend upon whether the new level of inventory is to be maintained in future years or reverts to the beginning-of-year level. That is, management's short-run purchase decision is conditioned by the long-run target inventory level which, in turn, affects the duration of the potential tax benefits.

Several recent papers have addressed this management decision. For example, Cohen and Halperin [1980] construct a nonlinear program in which the objective is to maximize cash flows over a multi-year planning horizon. The optimal decision depends on: (1) the unit price of potential purchases, (2) the expected price in the near future, (3) the price of the units in cost of goods sold replaced by the end-of-year purchase, (4) the firm's marginal tax rate, (5) incremental holding costs including the cost of capital, and (6) the level of inventory that would be optimal in the long-run.[7]

In the discussion that follows, we construct a simple two-period model of the net cost of a unit purchased at year-end. The appropriate decision rule depends on whether or not the year-end inventory level that results from a year-end purchase would exceed the level determined to be optimal in the long-run. In Case I, we assume that the purchase would not increase year-end inventories above this long-run target level. Thus, the decision faced by management is whether to purchase the unit of inventory now, or wait to purchase at some time in the next year. In Case II we consider the situation where a purchase would temporarily increase year-end inventories above the long-run target level.

Case I: Year-End Inventories are Less Than or Equal to the Long-Run Target Inventory Level

In this case, the decision as to whether or not to purchase additional inventory at year-end requires a comparison of the year-end price per pound, P_o, adjusted for taxes and holding costs, with the expected unit cost of purchasing coffee t periods in the future, P_t. Under LIFO, the cost of a unit purchased at year-end is charged directly to cost of goods sold, replacing the cost of a unit purchased earlier, P_h.[8] If $P_o > P_h$, the end-of-period purchase will reduce the firm's tax liability by $\tau(P_o - P_h)$, where τ denotes the marginal tax rate. Also, a decision to purchase now, rather than t periods from now, will cause the firm to incur carrying costs of C per period for t periods.[9]

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[6] Thus, we do not consider the benefits or costs of switching inventory costing methods to average cost or FIFO.

[7] In addition to the factors explicitly considered by Cohen and Halperin [1980], the decision may be influenced by the risk of stock-outs or obsolescence, unexpected price changes, and the effects of these decisions on contracts which rely on accounting numbers such as lending agreements or management compensation contracts. We defer the discussion of these factors until Section III.

[8] This unit may have been purchased earlier in the same fiscal year or in a prior year.

[9] Incremental carrying costs include storage, insurance, and taxes, as well as the cost of capital related to funds invested in inventories. Some components of C will vary with the number of dollars invested in inventory (e.g., the cost of capital) while other components may be

Therefore, assuming that the purchase does not increase inventories above the long-run target year-end level, the net cost of a unit purchased at year-end, P^*, can be modeled as a function of three components—the current price, the incremental carrying costs, and the tax savings.

$$P^* = P_o + P_oCt - \tau(P_o - P_h). \qquad (1)$$

If P^* is less than the expected future price, P_t, then it is cost effective to purchase now rather than wait until period t.[10]

Case II: Year-End Inventories Exceed the Long-Run Target Level

In the second case, we consider the costs and benefits of a year-end purchase that temporarily increases inventories above the long-run target level. This case is similar to Case I except that the taxes saved as a result of increasing the inventory level are now merely deferred until the inventory level is reduced to the target level. That is, the tax savings component from equation (1), $\tau(P_o - P_h)$, is reduced to the interest earned at the marginal after-tax borrowing rate, i, over the period, T, that taxes are deferred. Thus, a unit purchased now at a cost of P_o will be charged directly to cost of goods sold replacing a unit purchased at a cost of P_h. However, the unit costing P_h is expensed at period T in place of a unit that would have been purchased for P_t. The net cost, P^{**}, of purchasing at year-end rather than waiting until the following year becomes:

$$P^{**} = P_o + \left[\frac{1}{1-\tau}\right] \times [P_oCt - \tau(P_o - P_h)iT]. \qquad (2)$$

Thus, if the expected future price, P_t, is greater than P^{**}, then it would be cost effective to purchase at year-end, even if the resulting inventory level would exceed the long-run target level.

In summary, a manager has two relevant purchase costs to compare against expected future prices in deciding the amount of LIFO inventories to purchase at year-end.[11] As long as units purchased at year-end do not cause inventories to exceed the long-run target, the relevant purchase cost is P^*. For any units purchased which cause inventory levels to exceed the long-run target, the relevant purchase cost is P^{**}. If P^* (or P^{**}) is less than the expected future price, purchasing now would be preferred to purchasing later. Also, note from equations (1) and (2) that $P^{**} > P^*$ since $C > 0$ and $0 < \tau < 1$. In other words, the short-run benefits of a year-end purchase are greatest if the purchase decision is consistent with optimal long-run inventory levels (i.e., Case I).

After introducing the circumstances faced by Farmer Brothers management in fiscal year 1977, we apply the model developed in this section to their year-

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a function of units held (e.g., storage). Since the largest component of incremental carrying costs is likely to be the cost of capital, we express total incremental carrying costs as the dollars tied up in inventory, P_o, times the carrying costs per period, C (expressed as a percentage), times the number of periods, t.

In concept, C can also have a benefit side, e.g., the benefit of having additional safety stock to meet possible shortages caused by unforeseen events, thus, creating an enhanced ability to weather periods of unusual volatility.

[10] Since the year-end purchase decision involves a choice between buying now versus buying in the near future, a purchase at year-end can be viewed as a short-run investment in inventories. Such an investment should be evaluated using an interest rate that reflects a risk premium commensurate with the riskiness of the investment. We assume bankers take this risk into account when setting short-term interest rates. Hence, the short-term borrowing rate approximates the appropriate rate to use when evaluating this decision.

[11] Actually, since both P^* and P^{**} are functions of P_h, the manager faces two relevant costs for each layer that has been liquidated. Once an entire layer has been replenished, P^* and P^{**} would have to be recalculated based on the unit cost P_h for the next oldest layer.

end purchase decision. Later, we investigate whether factors in addition to carrying costs and tax savings influence the year-end purchase decision.

II. THE 1975 BRAZILIAN FREEZE AND ITS EFFECTS ON THE COMPANY

The Uncertainty of Commodity Prices

The financial success of companies dependent on commodities as inputs is obviously influenced by fluctuations in the prices of these inputs. Agricultural products and crude oil seem to be particularly susceptible to price fluctuations. A recent excerpt from *The Wall Street Journal* illustrates the problem.

> The coffee market is in the throes of an annual affliction called the frost season. During the winter in Brazil, the world's biggest coffee producer by far, a sudden and unpredictable frost can ravage supplies and create shortages so severe that prices can double or triple in weeks.
>
> The uncertainty has traders and analysts studying history, meteorological charts, moon phases, sun spots, the South Pacific ocean current, El Nino, and even astrology in an effort to become the proverbial one-eyed man in the kingdom of the blind [Valentine, 1986, p. 32].

The 1975 Freeze

Although coffee prices have experienced a generally upward trend in recent decades, they have been more notable for their volatility (see Figure 1). Price fluctuations are caused by dramatic changes in world supplies from year-to-year.

> A tree crop, coffee seedlings require three to five years to produce commercial yields. Yearly changes in production —except for crop disasters like the 1975 frost—are largely determined by the intensity of crop management practices, and the use or nonuse of fertilizers, fungicides, and other inputs.
>
> Additionally, coffee is grown mainly in tropical regions of developing countries, is highly labor intensive, and can be stored for years. As well, a single country, Brazil, commands a dominant role in world production, so any changes in world supply often are related to the size of the Brazilian crop [*Commodity Yearbook*, 1977, p. 114].

A severe frost in July 1975 reduced the 1976 Brazilian green coffee harvest to 9,300 60-kilo bags (the standard measure) from 23,000 bags the year earlier. After subtracting estimated domestic consumption, "exportable" production from Brazil fell to 1,800 bags from 15,000 the year earlier. Total world "exportable" production fell by more than 30 percent relative to the record crop of two years earlier [*Commodity Yearbook*, 1983, pp. 96–98].

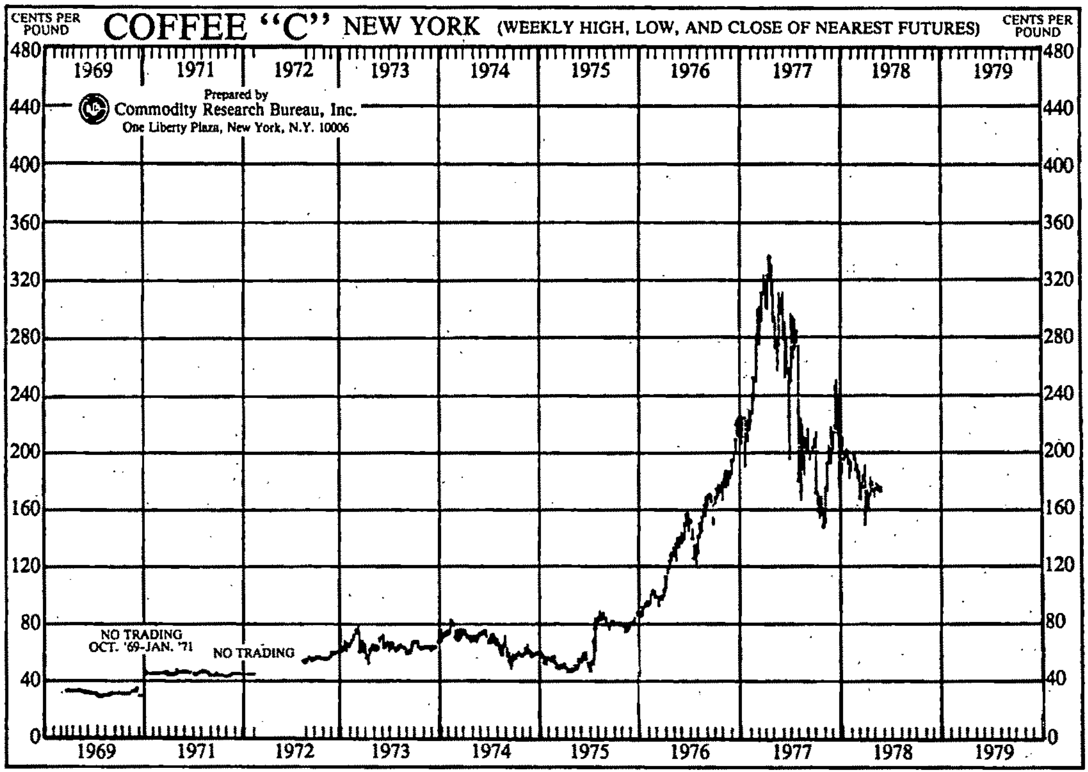
The Company and Fiscal 1977 Results

Farmer Brothers roasts and packages coffee and processes spices and other restaurant supplies at its main facilities in Torrance, California. In addition, the company manufactures a complete line of coffee-brewing equipment at its Brewmatic Division plant in Los Angeles.

In fiscal 1977 (ended June 30) Farmer Brothers reported record high sales revenue even though the quantity of coffee sold decreased by 2.7 percent from 40,628,328 pounds in 1976 to 39,544,583 pounds in 1977. The record dollar sales were precipitated by the aforementioned freeze in coffee-growing regions of Brazil and the resulting sharp increase in green coffee prices. Roy F. Farmer, President and Chairman of the Board of Farmer Brothers, opened his letter to shareholders in the 1977 annual report with the following commentary:

> The much publicized Brazilian frost of July [1975] and the shortage of coffee which it allegedly created, was used by producing countries to drive the cost of

FIGURE 1
GREEN COFFEE PRICES, PER POUND
1969–1978



Source: *Commodity Yearbook [1977]*

> green coffee to record highs. This situation, combined with our use of the Last-In-First-Out method of costing which channels the latest and most expensive purchases into cost of goods sold and applies those costs against sales made at prices based on earlier and lower costs, resulted in a pre-tax loss of $11,745,859 for fiscal 1977. This loss will enable the company to recover approximately $5,600,000 as a refund of income taxes paid in prior years [*Farmer Brothers Company*, 1977, p. 3].

Thus, as a result of aberrations in the coffee market and Farmer Brothers' use of LIFO inventory accounting, the company reported a net loss of $5,986,259 for fiscal 1977. The company's consolidated balance sheets and statements of earnings (and loss) for fiscal 1976 and 1977 are presented in Exhibits 1 and 2. In addition, the company's annual report included the following analysis by management:

> The continuing escalation of green coffee costs through most of fiscal 1977 was directly responsible for the large losses incurred by the company. During the period between January 1, 1977, and March 15, 1977, green coffee costs rose from $2.00 to $3.40 per pound. Farmer Bros. Co., in order to remain competitive, was forced to absorb a portion of the additional cost; conse-

EXHIBIT 1

CONSOLIDATED BALANCE SHEET

Farmer Bros. Co.

	June 30	
Assets	1977	1976
Current:		
Cash	$ 2,228,019	$ 587,965
Marketable securities, at cost (approximates market)	3,599,154	3,101,902
Accounts receivable, less allowance for doubtful accounts of $480,000 in 1977 and $375,000 in 1976	13,434,729	7,976,904
Federal and State income taxes receivable	5,973,213	1,422,582
Inventories	17,826,847	15,434,893
Prepaid expenses	679,860	460,541
Total current assets	43,741,822	28,984,787
Properties and equipment, at cost, less accumulated depreciation	10,009,444	8,731,176
Cash surrender value of life insurance	787,868	753,783
Other assets	1,023	6,952
	$54,540,157	$38,476,698
Liabilities		
Current:		
Accounts payable, including accrued items	$21,219,262	$11,144,547
Short-term borrowings	12,887,518	—
Deferred taxes	115,267	105,422
Total current liabilities	34,222,047	11,249,969
Long term:		
Notes payable	626,156	626,156
Deferred taxes	31,024	166,169
	$34,879,227	$12,042,294
Shareholders' Equity		
Capital shares:		
Common	$ 1,968,037	$ 1,968,037
Additional paid-in capital	1,290,687	1,290,687
Retained earnings	16,402,206	23,175,680
	19,660,930	26,434,404
	$54,540,157	$38,476,698

Source: Farmer Brothers Company, 1977 annual report.

quently, our selling prices did not reach a level which would produce reasonable gross profit margins until May 1977. Because the company utilizes the Last-In-First-Out method of accounting for coffee costs, its latest purchases are channeled directly into costs of goods sold and are applied against sales which were made at prices based on earlier and lower priced green coffee purchases. The combination of the LIFO method of accounting and the delay in increasing selling prices produced heavy losses during the third quarter. Fourth quarter

Exhibit 2

Consolidated Statement of Income and (Loss)

Farmer Bros. Co.

	Years ended June 30	
	1977	1976
Sales	$135,271,053	$87,156,483
Cost of goods sold	124,267,341	64,799,214
Gross profit	11,003,712	22,357,269
Selling expense	19,615,507	17,752,185
General and administrative expense	3,485,365	2,962,941
	23,100,872	20,715,126
Income (loss) from operations	(12,097,160)	1,642,143
Other income, net	351,301	444,268
Income (loss) before provision (credit) for taxes	(11,745,859)	2,086,411
Provision (credit) for taxes on income	(5,759,600)	1,098,039
Net income (loss)	$ (5,986,259)	$ 988,372
Net income (loss) per average common share outstanding	$(3.04)	$ .50

Source: Farmer Brothers Company, 1977 annual report.

> operations resulted in the recovery of eight million of the 19 million dollar pre-tax loss incurred in the first nine months. The recovery can be attributed to two factors. First, at March 31, 1977, in anticipating the replacement of (liquidated) LIFO inventory, the company used $3.00 per pound as an estimated cost. Management, however, did not replenish the inventory at the time green coffee was priced at $3.00 per pound but waited and made its purchases at an average price of $2.32 per pound. The difference between the $3.00 estimate and the $2.32 actual cost accounted for approximately $4,750,000 of the fourth quarter profit. Second, the increase in selling prices raised our gross margins to a more reasonable level and this accounted for $3,940,000 in fourth quarter profits, while the addition of 1.9 million pounds of coffee to our LIFO base served to reduce the fourth quarter profit and increase the loss for fiscal 1977 [*Farmer Brothers Company*, 1977, p. 8].

Because of record high prices during the first three quarters of fiscal 1977, Farmer Brothers liquidated a substantial portion of the beginning-of-year inventory. Among the decisions faced by management during the fourth quarter was a series of decisions relative to whether or not to replace the LIFO layers liquidated earlier in the year, and whether or not to increase inventories above the level of beginning inventory. The above quote suggests that, late in fiscal 1977, management replaced approximately seven million pounds of green coffee liquidated in earlier quarters (=$4.75 million pre-tax savings ÷ ($3 − $2.32)) and added 1.9 million pounds to the LIFO base.

III. THE CASH FLOW EFFECTS OF THE YEAR-END PURCHASE DECISION

As modeled in Section I, the optimal year-end purchase decision depends on (1) the unit price of potential purchases at year-end, (2) the expected unit price that would be paid if the decision is to wait and purchase in the future, (3) the historic cost of the units replaced in cost of goods sold,[12] (4) the firm's marginal tax rate, (5) incremental carrying costs, and (6) the long-run target level of inventory. We limit our analysis by accepting management's choice of accounting policies.[13] We also assume that management viewed the beginning of fiscal 1977 LIFO base to be optimal given the economic conditions that prevailed in mid-1976. In other words, we assume that fiscal 1977 purchase decisions reflect current and expected economic conditions, and are not responses to known sub-optimal decisions of the past. In the discussion that follows, we examine the two cases discussed in Section I.

Additional Data for Fiscal 1976 and 1977

In order to apply the model developed in Section I to Farmer Brothers, we examined reported results for fiscal 1976 and 1977 to obtain additional data. From information in the annual reports and inventory note B (provided in panel A of Exhibit 3), we reconstructed the average unit cost of the total cost of 1977 coffee sold, as well as the average unit and total cost of the layers added to ending inventories in fiscal years 1976 and 1977 (see panel B of Exhibit 3). The base layer of approximately 12,800,000 pounds in Exhibit 3 reflects purchases prior to fiscal 1976. For purposes of illustration, we assume that each of the LIFO layers is homogeneous with respect to price, and that the end of fiscal 1977 price of coffee is $2.25; this is generally consistent with the pattern of prices portrayed in Figure 1.[14] The large differences in the unit costs across layers can be attributed to the use of the LIFO cost flow assumption and the widely fluctuating prices since 1975 (again see Figure 1).

Other information needed in the analysis to follow are the firm's tax rate and cost of capital. Based on tax note C (in the annual report), the company's marginal tax rate in fiscal 1977 was approximately 51.7 percent which is comprised of the 48 percent federal rate and a 3.7 percent state of California rate.[15] We assume that incremental carrying costs are comprised primarily of the cost of capital,[16] and that they can be approximated

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[12] That is, each pound of coffee purchased at year-end is immediately expensed in place of the oldest pound that would have been in the cost of coffee sold. This older pound of coffee is transferred to ending inventories.

[13] Thus, alternatives not considered include switching inventory methods to average cost or FIFO. For Farmer Brothers in fiscal 1977, a switch in accounting method would result in restating fiscal 1976 net income and retained earnings, and the requirement to repay taxes deferred while using LIFO. For example, a switch to FIFO would result in a cumulative effect on retained earnings equal to beginning-of-year difference between FIFO and LIFO inventory costs ($12,700,000 in Exhibit 3, panel A) less the tax effect of reporting on a FIFO basis.

[14] Figure 1 reflects 90-day futures prices and, therefore, does not precisely coincide with the data in the annual report which is based on purchases made at spot prices. Also, when reading Figure 1, again note that Farmer Brothers has a June 30 fiscal year-end.

If sales are approximately uniform across quarters, fourth quarter sales were approximately 9.9 million pounds. Since the company added 8.9 million pounds by year-end [Annual Report, p. 8], fourth quarter purchases must have been about 18.8 million pounds. Given prices were declining in the fourth quarter and assuming all purchases in that quarter averaged $2.32 [Annual Report, p. 8], we estimate that the last 8.9 million pounds averaged approximately $2.25.

[15] Marginal tax rates in fiscal 1976 and 1975 were 51.3 percent and 51.1 percent respectively. We initially assume that the marginal tax rate is symmetric for profits and losses. That is, if the company has a loss, it receives a refund of prior taxes at this marginal rate due to tax loss carrybacks. This assumption is discussed further later in the paper, in the context of limitations on tax loss carrybacks.

[16] That is, we assume incremental storage costs, insurance premiums, and inventory taxes are small relative to the cost of funds invested in inventories. Likely conditions where this would be the case include: if excess stor-

EXHIBIT 3
INVENTORY DATA, FARMER BROTHERS COMPANY FISCAL YEARS 1975–1977

Panel A: Excerpts from Inventories Note B, fiscal 1977 and 1976:

Inventories consist of the following:

	1977		*1976*		*1975*	
	Pounds	*Cost**	*Pounds***	*Cost**	*Pounds***	*Cost**
Coffee	19,677,532	$ 9,920,842	17,800,000	$ 7,706,245	12,800,000	$ 5,317,537
Allied Products		5,400,394		5,594,160		5,887,303
Brewmatic Equipment		2,505,611		2,134,388		2,362,052
		$17,826,847		$15,434,893		$13,566,892

Source: Farmer Brothers Company Annual Reports

* Coffee and allied products inventories are stated at cost, utilizing the LIFO method not exceeding market value. All other inventories are stated at cost under the FIFO method, not exceeding market value. Current cost of coffee and allied products inventories exceeded the cost based on the LIFO method by $40,800,000, $12,700,000, and $2,600,000 at June 30, 1977, 1976, and 1975, respectively.

** Estimates based on data from Farmers Brothers Company Annual Reports.

Panel B: LIFO Inventory Layers for Coffee, fiscal 1977, 1976, 1975, and earlier:

Cost of Coffee Sold in fiscal 1977

39,544,583 pounds at an average of $2.37 per pound = $93,884,710

1,877,532 pounds at $1.18 per pound = $2,215,488 added in fiscal 1977

5,000,000 pounds at $0.478 per pound = $2,390,000 added in fiscal 1976

12,800,000 pounds at $0.415 per pound = $5,317,537 added in fiscal 1975 and earlier

Source: Calculations by the authors from data in Farmer Brothers Company Annual Reports

by the borrowing rate because of the short-run nature of this end-of-year decision.[17] Note F in the annual report discloses the borrowing rate to be six percent throughout fiscal 1977. Therefore, we calculate the after tax incremental borrowing (or savings) rate related to end-of-year inventory decisions to be 2.9 percent (=.06 × [1 − .517]).

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age capacity exists, if insurance premiums are not tied to specific end-of-year inventory levels, and if inventories can be temporarily reduced during the time inventory taxes are levied.

[17] In this case, the investment risk associated with a short-term investment in coffee is directly related to the variability of coffee prices. We assume that Farmer Brothers' bankers took this risk into account in setting the short-term interest rate. The appropriateness of using the short-term interest rate was discussed earlier—see footnote 10.

TABLE 2

BREAK-EVEN COST OF BUYING ADDITIONAL UNITS AT THE END OF FISCAL 1977 RELATIVE TO WAITING UNTIL EARLY FISCAL 1978

Panel A—Case I: Year-End Inventories are Less Than or Equal to the Long-Run Target Inventory Level (i.e., long-run inventories are expected to be maintained at a level equal to or greater than the level reached at the end of the current year)

	Unit price of layer replaced in CGS (P_h)		
	(oldest) *$0.415*	*$0.478*	*(newest)* *$1.180*
Cost of unit purchased	$2.250	$2.250	$2.250
Tax savings $([\$2.25-P_h]\times 0.517)$	(0.949)	(0.916)	(0.553)
Interest, net of tax $(\$2.25\times .005\times 4\times[1-0.517])$*	0.022	0.022	0.022
Net cost adjusted for interest and taxes**	$1.323	$1.356	$1.719

Panel B—Case II: Year-End Inventories Exceed the Long-Run Target Level (i.e., optimal long-run inventories are lower than year-end levels)

	Unit price of layer replaced in CGS (P_h)		
	(oldest) *$0.415*	*$0.478*	*(newest)* *$1.180*
Cost of unit purchased	$2.250	$2.250	$2.250
Tax deferral $([\$2.25-P_h]\times 0.517)\times .005\times 12$	(0.057)	(0.055)	(0.033)
Interest, net of tax $(\$2.25\times .005\times 4)$*	0.045	0.045	0.045
Net cost adjusted for interest and taxes**	$2.238	$2.240	$2.262

* Based on the level of ending inventory, we assume that the Company could have waited approximately four months before replenishing liquidated inventories. While this obviously varies as a function of the amount actually on hand at the end of fiscal 1977, the values above are not significantly affected by refining this calculation.

** We hypothesize that these net break-even costs are compared with management's expectation of future coffee prices to determine whether to buy additional units now (at the end of fiscal year 1977) or wait until early fiscal year 1978.

Case I: Year-End Inventories are Less Than or Equal to the Long-Run Target Inventory Level

As discussed in Section I, the year-end purchase decision depends on whether ending inventory exceeds the long-run target level as a result of the purchase. We assume that this optimal long-run inventory is exogenously determined by management and first consider Case I where year-end purchases do not cause this target to be exceeded. Table 2, panel A illustrates the calculation of the net cost of fourth quarter 1977 purchases given prepurchase inventory levels. The net cost figures represent minimum expected 1978 coffee prices that justify 1977 year-end purchases. If expected early 1978 prices are below this net cost, *ceteris paribus*, management would prefer to wait to make additional purchases. A different net cost is calculated for each LIFO inventory layer that had been liquidated during the first three quarters of 1977. The three break-even prices that are computed reflect the tax savings that result from (1) replacing a unit that had been purchased before fiscal 1976 at an average of $0.415, (2) replacing a unit originally purchased in fiscal 1976 at $0.478, and (3) replacing a unit purchased early in fiscal 1977 at $1.18 (see Exhibit 3, panel B). Therefore, assuming that management expected to indefinitely maintain inventories at or above levels reached by year-end 1977, the net cost of year-end purchases were approximately (1) $1.32, (2) $1.36, and (3) $1.72, respectively. These net cost figures could then be compared to the expected cost of buying coffee in early fiscal 1978. For example, if management expected coffee prices to fall below $1.32 within a few months, it would have been optimal to wait until early fiscal 1978 and replace liquidated inventories at the lower price. However, if coffee prices were expected to remain above $1.72 per pound, then it would make sense to replace liquidated inventories before year-end. Finally, if prices were expected to be between $1.32 and $1.72, then the optimal year-end strategy would be to replace some but not all of the liquidated LIFO layers.

Case II: Year-End Inventories Exceed the Long-Run Target Level

If the year-end purchase resulted in ending inventory levels that temporarily exceed the long-run target (i.e., Case II), the tax savings calculated above become a tax deferral for the number of periods (T) in which inventories are maintained above the long-run target (for the portion of the purchase that results in the "excess" inventory). Table 2, panel B, illustrates the net cost calculations for Farmer Brothers under this assumption. Note that the tax savings resulting from year-end purchases is approximately offset by the additional carrying cost of buying now rather than waiting until period t. As a result, if Farmer Brothers management expected coffee prices to drop below the year-end 1977 price of about $2.25 in early fiscal 1978, they would have been better off to wait until prices fell before making additional purchases.

Determining the Optimal Quantity of Year-End Purchases

Having estimated other factors in the model, the optimal year-end purchase decision depends on both the expected price of coffee in early fiscal year 1978 and management's target long-run inventory level (LRI). Table 3 presents the optimal quantities of year-end purchases for various levels of these two unknowns.[18] For example, if prices were expected to fall below a $1.72 per pound, but remain above a $1.36 (col. 3 in Table 3), the optimal decision would be to purchase up to seven million pounds of coffee at year-end. However, it would not be desirable to exceed management's LRI. Therefore, if the LRI is greater than or equal to 17.8 million pounds (in row 4 or 5), the optimal year-end purchase would be seven million pounds (17.8 million −10.8 million). But, if the LRI is less than 17.8 million pounds, then it would make sense to replace liquidated inventories up to (but not exceeding) the LRI.

Values in Table 3 highlighted by an asterisk (*) are purchase decisions consistent with increasing inventories above the LRI (i.e., Case II). This would be the optimal if prices were expected to remain at or above the year-end price of ap-

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[18] As indicated at the end of Section II, we infer from management's comments in the annual report that, by the end of the third quarter of fiscal 1977, Farmer Brothers had liquidated approximately seven million pounds relative to beginning of year levels, leaving a LIFO base of 10.8 million pounds.

TABLE 3
OPTIMAL YEAR-END PURCHASES AS A FUNCTION OF TARGET LONG-RUN INVENTORY LEVELS AND EXPECTED FUTURE PRICES[1]

Target Long-Run Inventory Level	Range of Expected Future Prices						
	Less than $1.323	*$1.323 to $1.356*	*$1.356 to $1.719*	*$1.719 to $2.238*	*$2.238 to $2.240*	*$2.240 to $2.262*	*Above $2.262*
LRI†<10.8‡	0	0	0	0*	2*	7*	**8.9***
10.8≤LRI<12.8	0	LRI-10.8	LRI-10.8	LRI-10.8	2*	7*	**8.9***
12.8≤LRI<17.8	0	2	LRI-10.8	LRI-10.8	LRI-10.8	7*	**8.9***
17.8≤LRI<19.7	0	2	7	LRI-10.8	LRI-10.8	LRI-10.8	**8.9***
19.7≤LRI<50.3	0	2	7	**8.9****	**≥8.9*****	**≥8.9*****	**≥8.9*****

† LRI=Target (optimal) long-run inventory level.
‡ Inventories are stated in millions of pounds.
* Indicates Case II, where the long-run target level of inventory is exceeded in the short-run. Since we assume a start with 10.8 million pounds, the entire first row is consistent with Case II. Non-starred entries in the table are consistent with Case I, where year-end inventories are less than or equal to the long-run target level.
** Bold face type indicates scenarios consistent with Farmer Brothers' actual decision.
*** The amount purchased above 8.9 million pounds is a function of the price and size of the next layer(s). However, total inventories would not exceed LRI.
[1] Entries in this table reflect rational decisions consistent with our model (in Section I) and assumptions.

proximately $2.25 per pound. However, if prices were expected to drop below $2.24, then Case I applies, and it would have been suboptimal to exceed the LRI.

Farmer Brothers' management chose to increase inventories by 8.9 million pounds in the fourth quarter of fiscal 1977. Situations consistent with this decision appear in Table 3 in boldface type in the far right-hand column and in the right-hand part of row 5.[19] The remaining (non-boldface) entries in Table 3 present situations in which the optimal year-end purchase decision was to replace some but not all of the LIFO layers liquidated earlier in the year.

If we assume that management's decision was optimal, we can infer that either management expected prices to remain at or above $2.26 per pound, *or* that the LRI was at least 19.7 million pounds, and prices were expected to remain above $1.72. However, if management expected prices to drop below $1.72 per pound, or if the LRI was below 19.7 million pounds, then the purchase of 8.9 million pounds at year-end was apparently suboptimal.

Since, at June 30, 1977, the 90-day coffee futures price was approximately $2.25 and appeared to be falling, Farmer Brothers' decision is consistent with prices not falling below $1.72 and an LRI of at least 19.7 million pounds (i.e., col. 4 and row 5 of Table 3). Examination of subsequent annual reports reveals that ending inventories did not drop below end of fiscal 1977 levels through fiscal 1980.[20] However, even if the LRI was greater than 19.7 million pounds, it would not necessarily be desirable to in-

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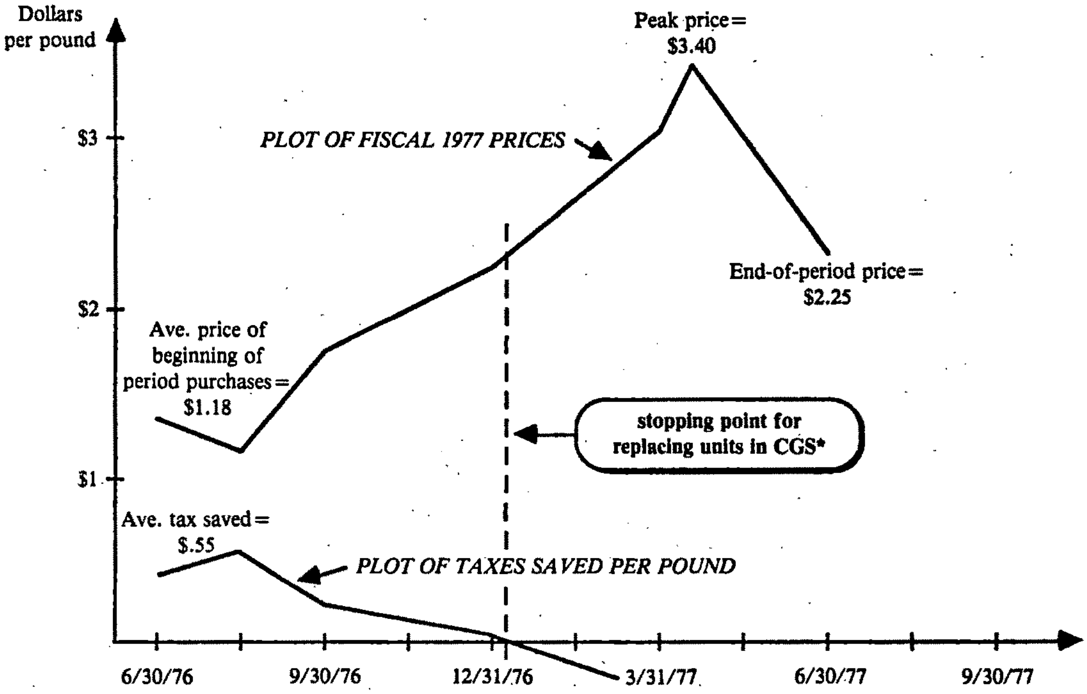
[19] The three cells in the far right of the last row represent situations where the optimal decision could be to buy more than 8.9 million pounds. Since we cannot observe the price and size of layers purchased after the $1.18 layer, we cannot determine the optimal total purchase.

[20] For example, the inventory note in the 1980 Form 10-K reveals that coffee inventories have been maintained above end-of-fiscal 1977 levels. Coffee inventories declined in fiscal 1981, but were still above beginning-of-fiscal 1977 levels.

FIGURE 2

STOPPING POINT FOR END-OF-PERIOD PURCHASES AS A FUNCTION OF FISCAL 1977 PRICES



* The tax benefits of additional purchases at year-end diminish as the price per pound of the LIFO layer being shifted from CGS to inventories approaches the price per pound of end-of-period purchases. Thus, in fiscal 1977, if end-of-period purchases cost $2.25, the "stopping point" for units replaced in cost of goods sold is also $2.25, assuming no incremental carrying costs (e.g., interest, storage, handling).

crease inventories to the long-run target level in fiscal 1977. The tax benefits of additional purchases diminish as the price per pound of the LIFO layer being shifted from cost of goods sold to inventory approaches the price per pound of the year-end purchases (i.e., as $\tau(P_o - P_h)$ approaches zero). As a result, it would not be desirable to replace liquidated LIFO layers that had cost $2.25 or more per pound. This is illustrated in Figure 2.[21]

IV. ADDITIONAL CONSIDERATIONS AFFECTING THE YEAR-END PURCHASE DECISION

The decision model presented in Section I incorporates two parameters which may be difficult to specify completely: the marginal tax rate, τ, and incremental carrying costs, C. Below, we examine some additional considerations relating to these parameters. We also consider the financial statement and related contracting effects of the year-end purchase decision.

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[21] Given non-zero carrying costs (e.g., interest, storage, insurance, and handling), the optimal stopping point for purchases may be before the price of the layer added to ending inventories reached $2.25. Additional factors affecting the optimal year-end action are discussed below.

Additional Carrying Costs (and Benefits)

In the preceding analysis, we have limited our estimate of inventory carrying costs to the cost of capital. However, other factors, including incremental storage, insurance, and handling costs, should also be considered.[22] Each of these components, if included in our estimate of carrying costs, would have the effect of increasing the break-even price—making a purchase before the end of the fiscal year less desirable. Moreover, the incremental carrying costs, C, may well increase as the quantity purchase increases due to constraints on storage capacity and short-term credit limits. This would serve to limit the total *amount* of inventory purchased at year-end.

In contrast to these factors, one potentially significant benefit of holding higher levels of inventory is that the risk of stock-outs is reduced. The Brazilian freeze created shortages of coffee and contributed to record coffee prices. Farmer Brothers management, as a supplier of coffee to institutions, is likely to be particularly concerned about having adequate inventories during such periods. To the extent that stock-outs cause reduced customer loyalty, management has an incentive to hold higher levels of coffee.[23] A related factor emphasized in the 1977 annual report was that the added inventory would provide Company management additional flexibility in withstanding short-run price fluctuations. This factor is consistent with management's stated reason for increasing inventory levels:

> The LIFO base is now at a level which, in the opinion of management, will enable it to freely adjust its inventory purchases to coincide with changes in economic conditions [*Farmer Brothers Company*, 1977, p. 4].

Limits on Tax Benefits

Although the anticipated tax savings provide the primary incentive to replace liquidated LIFO inventories before year-end, the tax loss carryback/carryforward provisions of the tax code help to limit the *amount* of purchases that would be made. After all available carrybacks have been used to apply for a tax refund, the economic value of tax loss carryforwards will be less than their nominal amounts because of the time value of money, compounded by any uncertainty of the company achieving future taxable income.[24] Farmer Brothers' year-end purchases forced the company to report a before tax loss of almost $12,000,000. It is probably no coincidence that all available net operating loss carrybacks were utilized and only $200,000 was carried forward to future years.

> The large loss incurred in fiscal 1977 enabled the corporation to recover approximately $5,900,000 in previously paid federal and state income taxes. It is expected that this influx of cash, combined with operating revenues, will substantially minimize any need to borrow additional funds during fiscal 1978. This expectation is contingent upon the continued stabilization of green coffee prices [*Farmer Brothers Company*, 1977, p. 8].

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[22] All of these costs were included in the model in Section I under the category of carrying costs, C. Unfortunately, many of the components of carrying costs are difficult to quantify using publicly available data and are being discussed here as possible omitted data.

[23] Normally, the risk of obsolescence, shrinkage, or spoilage would offset the risk of stock-outs to some extent.

[24] An additional negative factor is that the carryforwards generally cannot be treated as an asset for financial reporting. See the "Aetna Life and Casualty Company" case in Pfeiffer and Bowen [1985, p. 128–132].

TABLE 4

EARNINGS AND INCOME TAX EFFECTS OF ALTERNATIVE LEVELS OF ENDING INVENTORY

Ending Inventory in Pounds	*Cost of Coffee Sold*	*Earnings (Loss) Before Income Taxes*	*Income Tax Liability (Refund)**
19,677,532†	$93,884,710	($11,745,859)	($5,769,445)
17,800,000	$91,875,751††	($9,736,900)†††	($4,730,813)††††
12,800,000	$83,015,751	($876,900)	($150,193)
10,000,000	$77,877,751	$4,261,100	$2,506,153
0	$59,527,751	$22,611,100	$11,993,103

* The tax liability (or refund) is estimated as tax expense adjusted for the change in the deferred tax liability.

† The first row reflects data reported at the end of fiscal 1977.

†† The remainder of this column was calculated by using the average unit costs in LIFO layers from panel B of Exhibit 3. For example, if ending inventory was 17.8 million pounds, cost of coffee sold (CCS) is calculated by removing $2.25 × 1,877,532 lb. from CCS and adding $1.18 × 1,877,532 lb. to CCS.

††† Reported earnings is adjusted by the estimated effect on CCS. For example, ($9,736,900) = ($11,745,859) + $93,884,710 − $91,875,751.

†††† The remainder of this column is calculated by adding the tax on the incremental income to the first entry. For example, ($4,730,813) = ($5,769,445) + .517 × [($9,736,900) − ($11,745,859)].

Financial Statement and Contracting Effects of the Year-End Purchase Decision

Table 4 illustrates the relation between the size of ending inventories, reported cost of coffee sold, and net income before taxes across different year-end inventory levels. The first row reflects the financial statement numbers as reported by Farmer Brothers in fiscal 1977. In subsequent rows, we estimate the financial reporting effects of liquidating LIFO layers. Management easily could have increased fiscal 1977 reported profits by not replacing liquidated LIFO layers. For example, if management had depleted coffee inventories down to ten million pounds, net income before taxes would have increased to over $4,000,000 instead of a reported loss of $11,745,859 (see col. 3 of Table 4). However, this would have resulted in a tax liability of approximately $2.5 million instead of a refund of almost $6 million. Tax implications of other alternatives are estimated in the right-hand column of Table 4.

As mentioned earlier, an effect on reported profits or assets may, in turn, also influence contracts between owners and outside parties (e.g., via covenants in lending agreements) and/or between owners and management (e.g., via the management compensation plan). To reduce agency costs, many firms enter into contractual arrangements written in terms that rely heavily on reported financial accounting numbers, especially earnings.[25] Contracts are often written between lenders and the company which allow for borrowing only after restricting management actions in certain areas. However, in the case of Farmer Brothers in fiscal 1977, neither the 10-K nor the annual report disclose any contractual restrictions associated with the company's outstanding debt. We interpret this lack of disclosure to imply that restrictive covenants were not a material factor relevant to preparation of the financial statements. We can only conclude that any restrictive covenants that exist were not a significant constraint on managerial decisions.

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[25] See Watts and Zimmerman [1986, chaps. 8 and 9] for a discussion of the role of accounting in the contracting process. See Smith and Warner [1979] for evidence on the use of accounting numbers in debt covenants, and Jensen and Meckling [1976] for elaboration on contracting to reduce the conflict between owners and managers.

Contracts are also frequently written between owners and management to better align their respective interests. These contracts often take the form of bonus plans which tie management's compensation directly to reported earnings. Hence, the year-end LIFO purchase decision, which may adversely affect reported earnings, could lead to lower management bonuses. This link between bonus compensation and reported profits provides an incentive to management to focus on reported earnings instead of cash flow. Jensen and Meckling [1976] show that the conflict of interest between owners and managers increases as the percentage of equity owned by management decreases. An examination of the Company's proxy statement reveals that company president, Roy Farmer, owned or was the sole trustee for various family trusts which, in total, represent greater than 40 percent of the outstanding stock. In addition, Mr. Farmer's sister owned in excess of ten percent of the outstanding stock. These data, indicating a closely held company, suggests that top management may have little direct reason to be influenced by reported accounting numbers. Further, the proxy statement did not reveal the existence of any bonus compensation plans. Even if undisclosed bonus agreements (tied to reported earnings) existed, it is unlikely that management would have been influenced by such plans in fiscal 1977. Most bonus plans require that earnings exceed a prespecified threshold before bonuses can be paid. Even without increasing year-end inventories above beginning-of-year levels, the company would have been unprofitable and, thus, no bonuses would have been paid in fiscal 1977 (see Table 4). Further, had management elected to liquidate sufficient LIFO layers to show a reported profit, the Company would have faced substantial economic penalties including a tax liability on the reported profit and a much lower safety stock of inventory in a period of continued price volatility. Thus, for all these reasons, it would appear that the effect of the fiscal year-end purchase on reported accounting numbers was of relatively little consequence in the decision.

V. SUMMARY AND EVALUATION OF FARMER BROTHERS' YEAR-END PURCHASE DECISION

In this paper, we provided a decision model for the year-end purchase decision faced by the management of a LIFO firm. Next, we examined this decision in the context of the situation faced by Farmer Brothers' management in fiscal year 1977. We enumerated the options available to management at the end of fiscal year 1977, and evaluated the conditions under which each alternative would be preferred.

In fiscal year 1977, Farmer Brothers' management added 1.9 million pounds of coffee to ending inventory despite expectations of: a continued decline in coffee prices into fiscal 1978; a slight drop in demand for coffee that resulted from high consumer prices; the borrowing and other costs of carrying higher levels of inventory; and a record decline in reported profits.[26] Although some of the important factors relevant to this decision are unobservable without inside information,[27] the motivation for the end-of-period decision appears to have been related to the tax and price risk considerations. For example, the company was able to use all available tax loss carrybacks to obtain a large tax refund.

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[26] Incremental borrowing costs incurred to finance year-end coffee purchases to "replace liquidated LIFO inventories and to increase its LIFO inventory base" were reported to be $196,267 in the 1977 annual report [p. 8].

Maintaining the estimates and assumptions discussed above (e.g., fiscal year 1977 year-end coffee prices equal $2.25 per pound; the marginal tax rate equals 51.7 percent; and incremental handling, stock-out, and insurance costs are insignificant), we can infer optimal purchase decisions as a function of expected coffee prices and target long-run inventory levels (see Table 3). Farmer Brothers' year-end purchase decision that increased ending inventory to 19.7 million pounds was consistent with two alternative scenarios: (1) management believed prices would increase above the year-end level, thus inducing the purchase of inventories above the long-run target; or (2) management believed prices would continue to fall, but desired to increase the long-run target to at least 19.7 million pounds. Since it seems highly likely that management expected that coffee prices would continue to fall after year-end (as the effects of the Brazilian freeze passed), we that infer management must have planned to maintain the new higher level of inventories well into the future. Examination of financial reports for the following three years (through 1980) are consistent with this prediction. Further, management must have believed that prices would not fall below approximately $1.72 within the next few months (prices did fall below $1.72 briefly in late calendar 1977 as shown in Figure 1). Otherwise, they would have been better off to only replace liquidated LIFO layers up to the beginning of fiscal 1977 level.

The value of acquiring even more inventory at the end of the fiscal year was likely constrained by a combination of the following factors: the declining tax benefit of additional purchases, incremental carrying costs, uncertainty about future prices and demand, and the ability to utilize tax loss carryforwards. Because the company president controlled a substantial portion of the outstanding common shares and because there was no evidence of lending covenants or other contracts tied to financial accounting numbers, management apparently had little reason to be concerned about reported losses and, instead, could focus on maximizing the cash flows available to the firm.

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[27] We made three separate attempts to discuss this decision with Farmer Brothers management. In each case, we were told that it was against company policy to release any information.

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American Accounting Association

Committees 1988–89

EXECUTIVE COMMITTEE

President—Gerhard G. Mueller, University of Washington
President-Elect—John K. Simmons, University of Florida
Vice President—Roger H. Hermanson, Georgia State University
Vice President—D. Gerald Searfoss, Touche Ross & Co.
Vice President—Robert E. Jensen, Trinity University
Secretary-Treasurer—Frank R. Rayburn, University of Alabama
Director of Education—Gary J. Previts, Case Western Reserve
Director of Research—Shyam Sunder, University of Minnesota
Director of Publications—William W. Cooper, University of Texas
Past President—William H. Beaver, Stanford University

COUNCIL

Section and Group Representatives

Accounting, Behavior & Organizations Section—Kenneth A. Merchant, Harvard Business School
Administrators of Accounting Programs Group—William F. Bentz, University of Oklahoma
Auditing Section—Robert G. May, University of Texas at Austin, and Gerald Smith, Bradley University
Government and Nonprofit Section—James L. Chan, University of Illinois at Chicago
International Accounting Section—Kenneth Most, Florida International University, and Kathleen Bindon, University of Alabama
IS/MAS Section—A. Faye Borthick, University of Tennessee
Management Accounting Section—Ronald V. Hartley, Bowling Green State University, and Shane Moriarity, University of Oklahoma
Public Interest Accounting Section—Paul Williams, North Carolina State University
Taxation (ATA) Section—Jane O. Burns, Texas Tech University, and W. Eugene Seago, Virginia Poly Institute & State University
Two-Year College Section—Jacqueline B. Sanders, Mercer County Community College

Regional Group Representatives

Mid-Atlantic Regional Group—Araya Debessay, University of Delaware, and J. Edward Ketz, Pennsylvania State University
Midwest Regional Group—Lawrence Sundby, St. Cloud State University, and Richard E. Baker, Northern Illinois University
Northeast Regional Group—Peter E. Battelle, University of Vermont, and Corine T. Norgaard, University of Connecticut
Ohio Regional Group—Richard Murdock, Ohio State University
Southeast Regional Group—Jan R. Williams, University of Tennessee, and Larry N. Killough, Virginia Poly Institute & State University
Southwest Regional Group—Sammie L. Smith, Stephen F. Austin State University, and Bruce Swindle, McNeese State University
Western Regional Group—Kenneth Euske, Naval Postgraduate School, and Ronald A. Milne, University of Nevada-Las Vegas

Members at Large

C. Edward Arrington, University of Iowa
James K. Loebbecke, University of Utah
Joseph E. Rhile, Lake Sumpter Community College
Mary S. Stone, University of Alabama

REGIONAL VICE PRESIDENTS

Northeast

Peter E. Battelle, The University of Vermont

Mid-Atlantic

Araya Debessay, University of Delaware

Ohio

Richard J. Murdock, Ohio State University

Midwest

Paul M. Fischer, University of Wisconsin

Southeast

Larry N. Killough, Virginia Polytechnic Institute & State University

Southwest

Sammie L. Smith, Stephen F. Austin State University

Western

Ronald A. Milne, University of Nevada–Las Vegas

SECTION OFFICERS

Accounting, Behavior & Organizations Section

Chairman: Kenneth Merchant, Harvard Graduate School of Business
Vice Chairman (academic): Norman MacIntosh, Queens University
Vice Chairman (practice):
Secretary-Treasurer: Kenneth Ferris, Southern Methodist University

Administrators of Accounting Programs Group

President: William F. Bentz, University of Oklahoma
Vice President: Dwayne C. Dowell, Abilene Christian University
Secretary: Bruce Oliver, Rochester Institute of Technology
Treasurer: Daniel O'Mara, Villanova University

Auditing Section

Chairman: Robert G. May, University of Texas
Vice Chairman (academic): Andrew D. Bailey, Jr., Ohio State University
Vice Chairman (practice): Robert S. Roussey, Arthur Andersen
Secretary-Treasurer: Jean C. Wyer, Coopers & Lybrand

Government and Nonprofit Section

Chairman: James L. Chan, University of Illinois at Chicago
Chairman-Elect: R. Penny Marquette, University of Akron
Secretary: James M. Patton, University of Pittsburgh

Information Systems/Management Advisory Services Section

Chairman: A. Faye Borthick, University of Tennessee
Vice Chairman (academic): Graham Gal, University of Massachusetts
Vice Chairman (practice): Thomas G. Farrell, Coopers & Lybrand
Secretary-Treasurer: Severin V. Grabski, Michigan State University

International Accounting Section

Chairman: Kenneth Most, Florida International University
Vice Chairman (academic): Kathleen Bindon, University of Alabama
Vice Chairman (practice): Arthur Wyatt, Arthur Andersen & Co.
Secretary: Gary Meek, Oklahoma State University
Treasurer: Juan Rivera, University of Notre Dame

Management Accounting Section

Chairman: Shane Moriarity, University of Oklahoma
Vice Chairman: Don K. Clancy, Texas Tech University
Secretary-Treasurer: Terry Campbell, Pennsylvania State University

Public Interest Accounting Section

Chairman: Paul Williams, North Carolina State University
Vice Chairman: Edward C. Arrington, University of Iowa
Secretary-Treasurer: Jean DuPree-Martin, Tennessee Tech University

Taxation (ATA) Section

President: Jane O. Burns, Texas Tech University/CBA
President-Elect: W. Eugene Seago, Virginia Poly Institute & State University
Vice President: Sandra S. Kramer, University of Florida
Secretary-Treasurer: William N. Kulsrud, Indiana University

Two-Year College Section

Chairman: Jacqueline Sanders, Mercer County Community College
Vice Chairman: Beverly Terry, Central Piedmont Community College
Secretary: Helen Gerrard, Miami University

AAA/AACSB/AICPA ACCOUNTING EDUCATION POLICY REVIEW COMMITTEE

Charge: 1. To determine the status of recent education policy initiatives of the three named organizations plus those of selected other professional accounting organizations like NAA, AWSCPA, and NABA.

2. To assess reciprocal effects of these initiatives and distill from them appropriate follow-up activities for AAA.

3. To make specific recommendations to the Executive committee as early as feasible.

Chairperson: Ray M. Sommerfeld, University of Texas
William F. Bentz, The Ohio State University
Melvin C. O'Connor, Michigan State University
David B. Pearson, Arthur Young & Company
M. Mendel Piser, Crowe Chizek & Company
William G. Shenkir, University of Virginia
Wilfred C. Uecker, Rice University
Robert L. Virgil, Jr., Washington University

ACCOUNTING EDUCATION ADVISORY COMMITTEE

Charge: 1. To develop and issue position statements on matters relating to accounting education.

2. To develop and recommend to the Executive Committee educational policy for the Association.

3. To initiate, coordinate, and administer the activities of the Association in the field of accounting education, including accounting education research and continuing professional education.

4. To coordinate the work of committees for the Doctoral Consortium, Doctoral Programs, New Faculty Consortium, Trueblood Seminars, Professional Examinations, and other education-related committees that may be established during the year.

Chairperson: Gary J. Previts, Case Western Reserve University
Bruce A. Baldwin, Portland State University
John D. Bazley, University of Denver

Charles G. Carpenter, Miami University
Raymond J. Clay, Jr., North Texas State University
Edward N. Coffman, Virginia Commonwealth University
Daniel L. Jensen, The Ohio State University
Bernard J. Milano, KPMG Peat Marwick
Ms. Aurora Rubin, Deloitte Haskins & Sells
Jan R. Williams, University of Tennessee
Ms. Barbara Zarkowski, Bellevue Community College

ACCOUNTING EDUCATOR AWARD COMMITTEE

Charge: To select one, two, or, at most, three recipients of the Outstanding Educator Award using the criteria approved by the Executive Committee.

Chairperson: Robert T. Sprouse
Rita P. Hull, Virginia Commonwealth University
John L. Kramer, University of Florida
Theodore J. Mock, University of Southern California
Gary L. Sundem, University of Washington
Jerold L. Zimmerman, University of Rochester

BYLAWS COMMITTEE

Charge: To review the Association's bylaws and recommend appropriate revisions to the Executive Committee.

Chairperson: Doyle Z. Williams, University of Southern California
Alvin A. Arens, Michigan State University
Frank R. Rayburn, University of Alabama
Arthur Wyatt, Arthur Andersen & Co.

CARTER SCHOLARSHIPS COMMITTEE

Charge: 1. To collect and evaluate applications for the Carter Foundation Student Scholarships.
2. To recommend amounts of stipends.
3. To rank applications and to transmit the ranking to the trustees of the Foundation.

Chairperson: Judith A. Kamnikar, Auburn University at Montgomery
Donald E. Kieso, Northern Illinois University
Eldon C. Lewis, California State University at San Bernardino

COMPETITIVE MANUSCRIPT AWARD COMMITTEE

Charge: To select recipient(s) of the Competitive Manuscript Award using criteria approved by the Executive Committee.

Chairperson: Chee W. Chow, San Diego State University
Rajiv Banker, Carnegie-Mellon University
Gary C. Biddle, University of Washington
Stephen H. Penman, University of California–Berkeley
Ira Solomon, University of Illinois
Charles W. Swenson, University of Southern California

DELOITTE HASKINS & SELLS WILDMAN MEDAL COMMITTEE

Charge: To administer the John R. Wildman Medal award program in accordance with the terms of the grant from the Deloitte Haskins & Sells Foundation.

Chairperson: Carl S. Warren, University of Georgia
Urton Anderson, University of Texas at Austin
Kenneth H. Heller, George Mason University
Richard Leftwich, University of Chicago
Marc F. Massoud, Claremont-McKenna College
Shane R. Moriarity, University of Oklahoma
Loren A. Nikolai, University of Missouri–Columbia
Lester M. Sussman, Deloitte Haskins & Sells

DOCTORAL CONSORTIUM COMMITTEE

Charge: 1. To plan the 1989 Doctoral Consortium in accordance with established AAA policies.
2. Upon approval and funding, to arrange to have the consortium conducted and administered.
3. To report on its results, effectiveness, and recommended changes by November 1, 1989.

Chairperson: James Jiambalvo, University of Washington
Ronald W. Hilton, Cornell University
Zoe-Vonna Palmrose, University of California-Berkeley
Gerald L. Salamon, Indiana University

DOCTORAL PROGRAMS COMMITTEE

Charge: 1. To carry out the plans made for the 1989 Doctoral Programs Conference.
2. To report on its results, effectiveness, and recommendations for Executive Committee follow-up actions by June 1, 1989.

Chairperson: Thomas H. Williams, University of Wisconsin
James R. Boatsman, Arizona State University
Daniel L. Jensen, The Ohio State University
D. Paul Newman, University of Texas at Austin

EMERGING ISSUES COMMITTEE

Charge: 1. To assimilate the recent strategic planning thrusts of the AAA, AICPA, and other relevant professional accounting organizations.
2. To determine appropriate consequences for AAA forward planning with respect to programs and organizational matters.
3. To advise the AAA President-Elect accordingly.

Chairperson: John K. Simmons, University of Florida
Philip B. Chenok, American Institute of Certified Public Accountants
J. Michael Cook, Deloitte Haskins & Sells
Thomas R. Dyckman, Cornell University
Robert Swieringa, Financial Accounting Standards Board
Doyle Z. Williams, University of Southern California

FINANCIAL ACCOUNTING STANDARDS COMMITTEE

Charge: 1. To meet in a full session with the FASB during 1988-89.
2. To establish AAA Regional Meeting liaison along lines recommended by the 1987-88 predecessor committee.
3. To evaluate selected discussions memoranda and exposure drafts related to financial accounting and reporting in the private sector as they are released by the FASB and to respond to the FASB in writing and by appearing at public hearings if necessary.

Chairperson: Joseph E. Mori, San Jose State University
Alex T. Arcady, Ernst & Whinney
Loyd C. Heath, University of Washington
William W. Holder, University of Southern California
C. Jevons Lee, The University of Pennsylvania
Raymond E. Perry, Touche Ross & Co.
Lawrence A. Tomassini, University of Illinois

GLOBAL AFFAIRS COMMITTEE

Charge: 1. To assess the activities of similar committees at the AICPA, AACSB, FEI, IIA, and NAA.
2. To assess the viability of the AAA Associate Organizations program.
3. In coordination with the AAA International Accounting Section to list, review, and evaluate all major association programs and activities with international dimensions.
4. To develop a simple strategic plan for AAA to sensitize the membership at large to the growing opportunities and challenges of global interdependence as they impact the field of accounting.

Chairperson: Harold E. Wyman, University of Connecticut
Kathleen Bindon, University of Alabama
George Foster, Stanford University

Irene Gordon, Simon Fraser University
William D. Hall, Arthur Andersen & Co.
Larry Horner, Peat Marwick Main & Co.
Yuji Ijiri, Carnegie-Mellon University
Konrad W. Kubin, Virginia Polytechnic Institute and State University
Larry McKibbin, University of Oklahoma
Robert M. Stephenson, IBM Corporation

INTERNATIONAL FACULTY EXCHANGE COMMITTEE

Charge: 1. To select the professors to be involved in the program for 1989-90.

2. To assist the Executive Director with announcements, arrangements, and follow-up evaluations for the respective visits.

Chairperson: Kenneth R. Ferris, Southern Methodist University
Murray J. Bryant, University of Toronto
Paul A. Griffin, University of California-Davis
Kazuo Hiramatsu, Kwansei Gakuin University
Lauren Kelley, University of Washington
Andre Zund, Switzerland

INVESTMENTS COMMITTEE

Charge: To recommend how AAA funds should be invested in accordance with established Executive Committee policies and procedures.

Chairperson: Frank R. Rayburn, University of Alabama
G. Michael Crooch, Arthur Andersen & Co.
Howard L. Godfrey, University of North Carolina
Nabil Hassan, Wright State University

MEMBERSHIP COMMITTEE

Charge: To increase the quantity and quality of the membership of the Association.

Chairperson: Donald J. Kirk, Columbia University
John W. Cook, Georgia State University
James R. Hasselback, Florida State University
Richard J. Murdock, The Ohio State University
Michael H. Sutton, Deloitte Haskins & Sells
Milton F. Usry, University of West Florida
John P. Walker, Wright State University
John J. Willingham, KPMG Peat Marwick

MINORITY FACULTY DEVELOPMENT COMMITTEE

Charge: 1. To examine and monitor minority recruitment programs of other professional organizations, such as the AICPA programs.

2. To explore ways in which potential minority candidates can be encouraged to apply to accounting doctoral programs and to pursue professional careers in accounting education.

3. To explore ways in which to encourage the development of minority faculty members.

4. To communicate key findings and appropriate recommendations, if any, to the Executive Committee.

Chairperson: Brenda Birkett, Southern University
John H. Engstrom, Northern Illinois University
Irvin Gleim, University of Florida
Donald C. Haley, Cleveland State University
John M. Hassell, Florida State University
Mark Kiel, North Carolina A&T State University
Milton Wilson, Howard University

MODEL LIBRARY—ELECTRONIC MEDIA COMMITTEE

Charge: 1. To carry forward the strategic and conceptual premises of the "model library for accounting" idea developed by the 1987-88 Model Library Committee.

2. To implement the recommendations of the predecessor committee as they relate to electronic media (i.e., databases, automated retrieval systems, data transfer, etc.).

Chairperson: Terry L. Campbell, The Pennsylvania State University
Robert Bricker, The Ohio State University
Lawrence D. Brown, S.U.N.Y. at Buffalo
Bala G. Dharan, Rice University
John C. Gardner, S.U.N.Y. at Buffalo
George M. Scott, University of Connecticut

MODEL LIBRARY—PRINT MEDIA COMMITTEE

Charge: 1. To carry forward the strategic and conceptual premises of the "model library for accounting" idea developed by the 1987–88 Model Library Committee.

2. To implement the recommendations of the predecessor committee as they relate to print media.

Chairperson: David R. Campbell, Case Western Reserve University
John B. Barrack, University of Georgia
Germain Boer, Vanderbilt University
A. Faye Borthick, University of Tennessee
J. Edward Ketz, The Pennsylvania State University
Phyllis A. Webster, University of North Carolina
Robert W. Williamson, University of Notre Dame

NEW FACULTY CONSORTIUM COMMITTEE

Charge: To plan the 1989 New Faculty Consortium in accordance with established AAA policies, to arrange to have the Consortium conducted and administered, to report on its results and effectiveness, and to recommend changes (if any) to the Executive Committee.

Chairperson: Thomas P. Howard, University of Missouri
Bruce A. Baldwin, University of Alabama
Michael A. Diamond, University of Southern California
Helen Gernon, University of Oregon
James H. Scheiner, University of Tennessee

NOMINATING COMMITTEE
NOTABLE CONTRIBUTIONS TO ACCOUNTING LITERATURE AWARD

Charge: 1. To nominate to the "AICPA-AAA Notable Contributions to Accounting Literature Committee" up to five selected books and articles each from those identified by the Screening Committee as potentially notable accounting literature contributions. Each nomination should be accompanied by a brief explanatory discussion of why the work qualifies as a "notable contribution."

2. To evaluate appropriate nominations for the tri-annual "Seminal Contributions to Accounting Literature" award and to make a final selection for the 1989 award.

Chairperson: William J. Bruns, Jr., Harvard University
Frederick D. S. Choi, New York University
Roland E. Dukes, University of Washington
Dale L. Gerboth, Arthur Young & Co.
Philip J. Harmelink, University of New Orleans
Robert Libby, University of Michigan
Ross L. Watts, University of Rochester

NOMINATIONS COMMITTEE

Charge: To select a list of nominees to AAA offices for election by the membership in August 1989.

Chairperson: Stephen A. Zeff, Rice University
Andrew D. Bailey, Jr., The Ohio State University
William H. Beaver, Stanford University
Jane O. Burns, Texas Tech University
Ronald V. Hartley, Bowling Green State University
Gerald Smith, Bradley University
Ray M. Sommerfeld, University of Texas at Austin

NOTABLE CONTRIBUTIONS TO ACCOUNTING LITERATURE AWARD SCREENING COMMITTEE

Charge: 1. To identify works of exceptional merit from published accounting books and articles that meet the guidelines for the "Notable Contribution" awards established by the Executive Committee.

2. To identify, similarly, works qualifying for the 1989 AAA "Seminal Contributions to Accounting Literature" award.

Chairperson: David Burgstahler, University of Washington
John C. Anderson, Syracuse University
John Arnold, Institute of Chartered Accountants of England and Wales
Frances L. Ayres, University of Oklahoma

Andrew D. Bailey, Jr., The Ohio State University
Stephen A. Butler, University of Oklahoma
Daniel W. Collins, Duke University
William D. Cooper, North Carolina A&T State University
Dan S. Dhaliwal, University of Arizona
Fawzi G. Dimian, University of Minnesota-Duluth
Trevor S. Harris, Columbia University
Paul M. Healy, Massachusetts Institute of Technology
John S. Hughes, University of British Columbia
Robert W. Ingram, University of Alabama
Betty R. Jackson, University of Colorado-Boulder
Barry L. Lewis, University of Colorado-Boulder
James G. Manegold, University of Southern California
William F. Messier, Jr., University of Florida
Kevin M. Misiewicz, University of Notre Dame
D. Paul Newman, University of Texas-Austin
Krishna G. Palepu, Harvard Business School
Kurt J. Pany, Arizona State University
R. H. Parker, University of Exeter
Judy D. Rayburn, University of Minnesota
Glenda E. Ried, University of Toledo
Walter A. Robbins, University of Alabama
Shahrkh Saudagaran, Santa Clara University
Jeffrey W. Schatzberg, University of Arizona
William R. Scott, University of Waterloo
Terry Shevlin, University of Washington
Kathleen E. Sinning, Western Michigan University
E. Kent St. Pierre, James Madison University
Gary L. Sundem, University of Washington
G. A. Swanson, Tennessee Technological University
Robert D. Swanson, Iowa State University
Richard G. Vangermeersch, University of Rhode Island
Robert L. Vigeland, University of Minnesota
William S. Waller, University of Arizona
G. Peter Wilson, Stanford University

PEAT MARWICK MAIN AUDITING PRACTICE & RESEARCH SEMINARS COMMITTEE

Charge: To assist Peat Marwick Main & Co. in the continuing conduct of the auditing seminars series.

Chairperson: Gerald Smith, Bradley University
Robert G. May, University of Texas at Austin
Jean H. Wyer, Coopers & Lybrand

PROFESSIONAL EXAMINATIONS COMMITTEE

Charge: 1. To evaluate the Uniform CPA Examination and to determine the appropriateness of the format and content of the exam.
2. To evaluate the impact of the CPA examination upon accounting education and curriculum.
3. To assess ways in which the entire examination process may be subjected to rigorous research.
4. To undertake the foregoing charges by reference to the work of the 1987-88 predecessor committee.

Chairperson: Charles H. Smith, The Pennsylvania State University
William Steve Albrecht, Brigham Young University
Clifton Brown, University of Illinois
Stan Chu, Borough of Manhattan Community College
Anthony T. Krzystofik, University of Massachusetts
Corine T. Norgaard, University of Connecticut
Martin E. Taylor, University of South Carolina

PROFESSIONALISM AND ETHICS SEMINARS COMMITTEE

Charge: To plan a "Professionalism and Ethics" seminar for 1989, in accordance with established AAA policies, to arrange to have the seminar conducted and administered, and to report on its results and effectiveness together with recommendations for future actions (if any) to the Executive Committee as early as feasible.

Chairperson: Harold Q. Langenderfer, University of North Carolina
Don Baker, Southwire Co.
Donald G. Baker, Arthur Andersen & Co.
Frederick D. S. Choi, New York University
Stephen E. Loeb, University of Maryland
William May, University of Southern California
Kenneth A. Merchant, Harvard Business School
Frederick L. Neumann, University of Illinois
Joann Rockness, North Carolina State University
Robert J. Sack, University of Virginia
Karin Skadden, Washington, DC

PROGRAM ADVISORY COMMITTEE

Charge: To assist the President and the Executive Director in developing the technical program for the 1989 annual meeting.

Chairperson: Douglas A. Snowball, University of Florida
Carl W. Alberni, Manhattan College
Andrew D. Bailey, Jr., The Ohio State University
Dan S. Dhaliwal, University of Arizona
Robert K. Elliott, Peat Marwick Main & Co.
Dale L. Flesher, University of Mississippi
Trevor S. Harris, Columbia University
Ronald W. Hilton, Cornell University
Gary K. Meek, Oklahoma State University
David B. Pearson, Arthur Young & Co.
R. David Plumlee, University of North Carolina
Gerald L. Salamon, Indiana University
William Schwartz, Temple University
Talmadge C. Tillman, Jr., California State University, Long Beach
Senyo Tse, University of Florida
Wanda A. Wallace, Texas A & M University

PUBLICATIONS COMMITTEE

Charge: 1. To monitor all aspects of the Association's growing publications program.

2. To report periodically to the President and Executive Committee on all matters of concern in the field of publications.

3. To recommend candidates for editor or editor-elect positions as appropriate.

4. To recommend AAA publications policies to the Executive Committee as deemed desirable.

Chairperson: William W. Cooper, University of Texas at Austin
Chee W. Chow, San Diego State University
William L. Felix, Jr., University of Arizona
Michael H. Granof, University of Texas at Austin
Yuji Ijiri, Carnegie-Mellon University
D. Gerald Searfoss, Touche Ross & Co.
Stephen A. Zeff, Rice University

RESEARCH ADVISORY COMMITTEE

Charge: 1. To monitor the accounting research activities of other accounting associations, e.g., AICPA, FEI, IIA, and NAA.

2. To advise the Director of Research in the development and administration of the Association's program in accounting research.

3. To suggest ways to encourage research in accounting, especially applied research dealing with all accounting functions in enterprise settings.

Chairperson: Shyam Sunder, University of Minnesota
Matthew J. Anderson, University of Minnesota
Andrew D. Bailey, Jr., The Ohio State University
Srikant Datar, Carnegie-Mellon University
John W. Dickhaut, University of Minnesota
Patricia J. Hughes, University of Southern California

SECURITIES AND EXCHANGE COMMISSION LIAISON COMMITTEE

Charge: 1. To prepare a response to the staff of the Securities and Exchange Commission on proposals soliciting views from the public concerning auditing and financial accounting and reporting.

2. To develop program(s) for the annual AAA meeting that will assist teaching of and conducting research in topics concerning the SEC and its activities.

3. Other activities as appropriate to assist communications and interactions between the SEC and the membership of the Association.

Chairperson: Paul B. W. Miller, University of Colorado at Colorado Springs
Bill N. Schwartz, Temple University
Ray G. Stephens, The Ohio State University
Mary S. Stone, University of Alabama
S. David Young, Tulane University

SEVENTH INTERNATIONAL CONFERENCE ON ACCOUNTING EDUCATION (1992) PLANNING COMMITTEE

Charge: 1. To evaluate critically the six predecessor conferences.

2. To initiate policy planning (e.g., type of conference, financing, and publicity) for this conference.

3. To recommend a theme, timing, and location of the conference to the Executive Committee as early as feasible.

Chairperson: Belverd E. Needles, Jr., DePaul University
Maureen H. Berry, University of Illinois
Philip C. Cheng, East Carolina University
Gary M. Cunningham, MacQuarie University
Amin A. Elmallah, California State University–Sacramento
Adolf J. H. Enthoven, University of Texas at Dallas
Thomas A. Gavin, University of Tennessee–Chattanooga
Sidney J. Gray, University of Glasgow
Lucile Lammers, Illinois State University
W. Morley Lemon, University of Waterloo
William Markell, University of Delaware
Alister Mason, Deloitte Haskins and Sells
Seigo Nakajima, Ferris Jogakuin Women's College
Norlin G. Rueschhoff, University of Notre Dame
George J. Staubus, University of California–Berkeley
Murray C. Wells, University of Sydney

STUDENT FELLOWSHIPS COMMITTEE

Charge: To select the 1988–89 recipients of American Accounting Association fellowship grants and to determine the amounts of these grants.

Chairperson: Philip H. Siegel, San Francisco State University
Herman R. Andress, Santa Fe Community College
Joyce S. Allen, Xavier University

TRUEBLOOD SEMINARS COMMITTEE

Charge: To assist Touche Ross & Co. in the continuing conduct of the Trueblood Seminars.

Chairperson: Lee H. Radebaugh, Brigham Young University
Richard J. Asebrook, University of Massachusetts
Anne Temple, Golden Gate University
Godwin T. White, College of William & Mary

WOMEN FACULTY DEVELOPMENT COMMITTEE

Charge: 1. To monitor women's professional career development activities in other professional accounting associations, including AICPA, FEI, IIA, and NAA.

2. To monitor similar activities in relevant other professional organizations.

3. To explore ways in which to encourage the development of women accounting faculty members.

4. To report the results of the committee's activities since 1987, together with appropriate recommendations, if any, by June 1, 1989.

Chairperson: Cheryl Lehman, Hofstra University
C. Edward Arrington, University of Iowa
Peter S. Goodrich, Providence College
Barbara Mull, Harford Community College
Marilyn Neimark, C.U.N.Y.–Baruch College

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BOOK REVIEWS

Richard P. Brief, Editor

Editor's Note: Books for review should be sent to Professor Richard P. Brief, 520 Tisch Hall, 40 W. 4th St., Schools of Business, New York University, New York, NY 10003.

RICHARD M. ALTMAN, *Creating Investor Demand for Company Stock: A Guide for Financial Managers* (New York: Quorum Books, 1988, pp. 397, $45.00).

Small emerging publicly-held firms often compete in a weak form of efficient market where obtaining efficient pricing for a firm's securities is a problem. This book is intended to show the financial manager of a firm how to achieve an "efficient market value" for its equity securities by creating investor demand.

The author states that investor demand is strongly related to information availability. For small firms this creates a problem in that research coverage by brokerage firm security analysts is concentrated in the hands of a relatively few analysts and focuses on relatively few public companies. Additionally, institutional ownership is skewed toward stocks with relatively large capitalizations. These two facts together combine to bias market sponsorship toward companies which offer high commission-generating potential to analysts and low liquidity costs to institutional investors, i.e., away from small capitalization firms.

There are lead investors, dominant sponsors, and an equity valuation network for every public company. Lead investors are value-oriented investors who command a following because of their superior track records. They attract dominant sponsors who in turn attract a flow of investment capital to a firm's stock. In this book, the author discusses how to identify, select, and communicate with lead investors and dominant sponsors.

The author contends that volatility of stock prices and trading volume are inversely related to the frequency that information is made available. Firms intent on maximizing the market value of their shares are thus advised to establish a program to communicate information on the company's cash-generating ability and growth/returns fundamentals. The extensive discussion contained in this book of what this program should entail is well-written and a useful addition to the literature.

Another strength of this book is its extensive citation of the academic and practitioner literature in the field. It is also one of its weaknesses. While the book attempts to incorporate ideas from both literatures, this effort is at times unsuccessful, yielding a book that is superficial from an academic perspective and dull and slow-paced from a practitioner's point of view. For example, the author indicates that some managers think they can regulate market efficiency in their companys' shares by making a single announcement of bad news while staggering publication of good news. It seems hard to believe that the market for the shares of a firm would be so inefficient that this ploy would be beneficial to the firm and no evidence is given to substantiate the claim.

The background of the author appears to be in journalism rather than in accounting or finance and this is reflected both in the substance and the style of the book. For example, the author states that "Cash dividends are a fixed operating cost" (p. 214), an assertion with which few would agree. In terms of the style of the book, there are only three, very basic figures, the last of which is incorrect. All equations are in the footnote section at the end of the text. The text itself has no mathematical symbols. Functional relationships are discussed verbally without mathematical models to serve as a guide. While this may have been done because of the practitioner orientation of the book, the results are probably less understandable, even to practitioners, than if equations had been used. In a similar manner, tables generally are not used to summarize data. Instead, numerical information is placed directly in the text. This yields pages of text that are nearly incomprehensible without extensive study.

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AHMED BELKAOUI, *Inquiry and Accounting: Alternate Methods and Research Perspectives* (New York; Westport, CT; and London: Quorum Books, a Division of Greenwood Press, Inc., 1987, pp. 448, $49.95).

This book sets out to provide a "critical examination of alternative images and foundations, approaches, methodologies, structures, and paradigms" available to accounting academics. Its stated intentions are to serve as a "guide to an understanding of the motivations and philosophies behind accounting thought" and to "provide academicians with a textbook to be used in research methodology courses" (p. xiv). It is not clear to this reviewer that it succeeds in either of these aims.

The book is approximately 450 pages long yet the author's own contribution is only 35 percent of this, the rest being reproductions of the work of others. This is a perfectly legitimate strategy for a textbook but the author fails to explain why the papers concerned were chosen and why they are an appropriate illustration of the principles that he discusses. Therefore, it is always unclear what didactic role these various appendices are intended to play.

A further difficulty concerns the structure of the discussion. The individual chapters are concerned with images and foundations, approaches, methodologies, structures, and paradigms as stated above. However, it is difficult to see how these individual areas co-relate. (For example, it is not clear how the chapter on "images and foundations" informs the discussion on methodology as no cross-reference is made in the text.)

The heart of the problem is that the book is insufficiently attentive to its intention of providing a "critical examination." A multiplicity of alternative theoretical outlooks are offered with no indication of how they might be problematic. In Chapter 2—Alternative Approaches—the Burrell and Morgan framework for classifying social theories is advanced. Yet, such an overview is implicitly relativist and effectively neutralizes the substantive points of conflict between, e.g., functionalist and interpretative approaches to social theory. As a consequence, the student will experience the book as a *montage* of theoretical positions with little guidance on how to assess their relative merits.

Chapter 5 on "Alternative Paradigms" is the longest at 35 pages and is easily the most interesting and useful; yet, there is little to connect it with what has gone before. This lack of a guiding thread is a serious problem for a textbook which concludes abruptly with an allusion to Watts and Zimmerman's "market for excuses" view of accounting theory. The author's well-intentioned eclecticism backfires by failing to provide a real understanding of the "motivations and philosophies" behind the different possible perspectives for accounting theory. The concern of this reviewer is that those theorists firmly entrenched in economics based views of accounting will find no reason for taking seriously the rise in "sociological consequences" that this book attempts to promote. As a co-traveller in this project, I find particularly problematic the condensed definitions of various philosophical positions such as "transcendental phenomenology" (p. 56) which read as so much jargon with little relevance to accounting. In addition, describing the work of Berkeley as "solipsistic" is not only wrong on any reasonable reading of his work but clearly plays little role in illuminating even a relatively sympathetic reader.

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CENTER FOR INTERNATIONAL EDUCATION AND RESEARCH IN ACCOUNTING, *Recent Accounting and Economic Developments in the Far East* (Urbana-Champaign, IL: The University of Illinois, 1988, pp. 234, $10.00).

This publication presents the proceedings of a recent conference devoted to accounting issues in the Far East. Presenters at the conference included academics and practitioners from North America and the Orient. The 12 papers presented are generally organized along the following lines. First, the author provides a historical perspective of accounting and auditing practices in the country or geographic region under review and then utilizes this background to compare and contrast those practices to related ones in the West.

The papers by Needles and Ninsuvannakul should be read first since they provide an overview of the accounting profession and auditing practices in the Far East. Needles describes such professional matters as auditor qualifications, legal and ethical standards, concepts of independence, and the degree to which accountants are subject to government regulation. Ninsuvannakul shows the extent to which International Accounting and Auditing Standards are followed on a country by country basis throughout the region. Both articles present matrix-like tables for ease of comparison across several countries. These tables, eight in the two papers, represent an extensive survey of country regulations in addition to information gathered from accounting societies and international accounting firms.

The remaining papers focus on specific countries. Given the recent liberalizations and economic freedoms in the Peoples Republic of China (PRC), it is not surprising that the largest number of papers, four, report on the PRC. In addition, there are two papers each on Japan and Hong Kong and one each on Korea and India.

The China papers, although separated in the book, should be read in conjunction with each other. Students of international accounting would be interested in how Western and Eastern authors look at similar Chinese issues and interpret them differently. The role and possible successes of joint ventures in China is just such an issue. A point made in the Simyar paper is that it is essential for Western managers to understand the underlying cultural and environmental issues of the Chinese business climate. The papers on the other countries note how the accounting and auditing practices have had to change in light of the rapid expansion of Western business practices in the various countries. For example, in Korea the trading volume of securities increased over 30 times from 1973 to 1984. This precipitated changes in government regulation that expanded the number of companies that were subject to audit; this, in turn, created a demand for more and better trained auditors to ensure that the investors in these capital markets were protected. The Hong Kong papers discuss the role of accounting in this financial center and how Hong Kong has to integrate the British accounting past with the PRC needs of the future.

An introduction, devoted to summarizing the papers in the conference, would have been helpful in giving the reader some indication of the theme of the conference. A summary might also have been provided to give some indication of which papers generated extended discussions outside of the formal presentation. This would give an overview to the conference and provide readers with some direction of future research.

In summary, this book will be of interest to those people who want to learn more about how the historical developments of accounting and auditing in the Far East have led to current practices. In addition, many tables in the text show how these current practices compare to those followed in the West.

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JEREMY EDWARDS, JOHN KAY, and COLIN MAYER, *The Economic Analysis of Accounting Profitability* (Oxford: Clarendon Press and New York: Oxford University Press, 1987, pp. 133, $39.95 cloth, $13.95 paper).

This is a fascinating book for anyone who has followed, even casually, the debate on whether accounting data can be used to make inferences about economic performance. The authors put forward a strongly argued case that accounting data, as long as balance sheets are prepared in accordance with the conventions of deprival value accounting and a comprehensive income concept is employed, can be used to generate an accounting rate of return which has economic significance. Such an economic rate of return would be of use to investors, economists, and regulators in evaluating how well a corporation has performed and also of partial help in evaluating the determinants of economic performance for an individual firm. A substantial part of the book builds on earlier published articles (in particular, Kay [1976] and Kay and Mayer [1986]). The presentation in the book, however, is substantially less technical than in the earlier published articles and, as a consequence, the material presented in the book is a great deal more accessible than hitherto.

An interesting aspect of the book is that it suggests that the fundamental line of attack of previous work in the area of estimating economic performance from accounting data is misguided. Previous studies have emphasized the relationship (or lack thereof) between the accounting rate of return and the internal rate of return. The authors argue, however, that an assessment of the firm's internal rate of return is largely irrelevant to most users of accounting data and, hence, whether or not accounting rates of return are adequate proxies for internal rates of return is an irrelevant question to ask. It must be pointed out, however, that the authors adopt a rather extreme definition of the internal rate of return of a firm. They define a firm's IRR as the rate of interest that equates the present value of the total lifetime inflows of the firm to the present value of the lifetime outflows of the firm (see the discussion on p. 33). Given such a definition, many would be inclined to agree with the authors that this measure is not of a great deal of interest. Indeed, it might be argued that the authors set up a "straw man." Certainly, whether this definition of the internal rate of return of a firm is commonly accepted is debatable. Although a similar definition is implicit in the analysis of Kay [1976], it is clear that, for example, Solomon [1966, 1970] has a different definition in mind. Solomon regards the internal rate of return of a firm in a period as the weighted average of the internal rates of return of each of the projects of the firm *active* in the specified period. The book would have benefited from a discussion of the relevance or irrelevance of Solomon's and any other possible definition of a firm's internal rate of return.

Perhaps of more importance, the authors argue that ranking firms by their IRRs is inappropriate. Specifically, they argue that the IRRs of firms cannot be used to compare the profitability of investments or firms (p. 18). The argument here is an *ex post* analogue of the *ex ante* argument that the IRR approach does not give the same decision as the net present value approach for a choice between mutually exclusive investments. An implication of this argument is that researchers, interested in the cross-sectional determinants of economic performance, who use the internal rate of return (proxied by the accounting rate of return) as the measure of economic performance will have a conceptually misspecified dependent variable.

The authors then make a positive case for the use of accounting rates of return (or multiperiod versions of the same referred to as accounting rates of profit) based on deprival value data. Their analysis suggests the following conclusions (p. 125):

> (i) an accounting rate of profit in excess of the cost of capital is *prima-facie* evidence of a barrier to entry at the beginning of the period;
>
> (ii) an accounting rate of profit less than the cost of capital is *prima-facie* evidence of a barrier to exit at the beginning of the period, provided that the closing assets are valued at economic value.

As befits economists, the main conclusions of the analysis are related to questions that economists (and, to a large part, regulators) might want answering. However, their recommended multiperiod accounting rate of profit is equal to an internal rate of return for a firm calculated as the rate of interest which equates a valuation of opening capital at deprival value and the present value of the intermediate cash flows and closing capital at deprival value. As a consequence, by the arguments advanced earlier in the book, their measure of economic performance is no more suitable for use in cross-sectional studies of economic performance than estimates of firms' IRRs.

The timing of the book is unfortunate. In both the U.K. and the U.S.A., the disclosure of current cost data of any form is no longer mandatory. In both countries, however, it might be argued that the emphasis on the information content of current cost data to a narrow set of user groups (e.g., investors and investment analysts), as opposed to considering the information content of such data to a wider set of users, has resulted in the disappearance of a form of disclosure that might have produced valuable data for public policy and social considerations. Certainly, the authors make a strong case that this is so. It needs to be pointed out, however, that, as a consequence of the decisions of accounting standard setters in the U.K. and the U.S.A., the authors' recommendations on how to measure accounting rates of return are difficult to implement in these two countries. It would be interesting to see the use of such measures in countries in which some form of current cost disclosure, based on deprival value, is still mandated.

All in all, this book is well worth buying and reading. It is written in quite a condensed fashion and the reader will have to read it a number of times to gain the full benefit of its arguments. The rewards, however, are well worth the effort. The book is organized in the following fashion. Chapter 1 introduces the book. Chapter 2 considers the assessment of the economic performance of complete activities using accounting profitability. Chapter 3 contains a fairly detailed discussion of the application of value-to-the-owner rules and points out that how these rules are to be applied depends upon the questions about economic performance being asked. Chapter 4 considers the assessment of economic performance of activities over limited time segments using accounting profitability data. Chapter 5 makes a case for "Real Terms" accounting and Chapter 6 compares accounting rates of return prepared under a variety of different bases. Chapter 7 considers the issue of how income tax expense and deferred income taxes ought to be measured in a deprival value system. Chapter 8 contains a conclusion and a summary of the authors' proposals.

In the U.S.A. this book is unlikely to find its way into many undergraduate courses in accounting as a consequence of its advanced level of analysis. It might be of use to instructors interested in giving courses on the use of accounting data to estimate economic performance on either M.B.A. or doctoral programs. The book's emphasis on the use of *a priori* theorizing to support any conclusions drawn could limit its current use at the doctoral level in the U.S.A. It is worth emphasizing, however, that the book is a work of considerable scholarship and to ignore it on the grounds that its epistomological foundations are no longer "fashionable" would constitute an intellectual crime. In the U.K. the book might be suitable for third-year undergraduate accounting theory courses and a place for it could certainly be found on Masters and doctoral courses in accounting theory.

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GABRIEL HAWAWINI and PIERRE MICHEL, *Mandatory Financial Information and Capital Market Equilibrium in Belgium*, Accounting Thought and Practice Through the Years series (New York and London: Garland Publishing, Inc., 1987, pp. 271, $25.00).

The objective of this book is "to investigate the impact of mandatory financial disclosure on the equilibrium pricing of firms traded on the Brussels Stock Exchange" (p. 9). In other words . . . to assess the informational content of mandatory financial disclosure in Belgium.

Belgium affords an interesting setting for such an information content study, since until the mid-seventies the Belgian legislation on corporate accounting and financial reporting was rather outdated relative to that in most advanced Western economies. This was changed in October 1976 by the Royal Decree on Accounting Standards and Financial Reporting which changed significantly financial reporting in Belgium. This legislation was expected to provide investors with new and useful information to assess the expected risks and returns of public companies' stocks. It is the information content of these new financial reports that is investigated by the authors. Information content is evaluated, as usual in this type of studies, by the impact of information release on various characteristics of stocks (prices, variances, etc.).

Chapter 2 of the book (following an introductory Chapter 1) provides institutional background; a historical review of accounting legislation in Belgium, starting with the Napoleonic Code of Commerce of 1803 and ending with the Royal Decree of 1976. Two extensive appendixes elaborate on the new legislation. (It would have been helpful if a comparison with U.S. GAAP had been provided.) It is interesting to note that a major force affecting the expansion of the Belgian financial reporting in the 1970s were the Workers' Councils, interested in providing employees with a clear view of the economic and financial conditions of their companies. Contrast this, and similar labor union involvement in financial reporting in some other European countries (e.g., Germany), to the negligible effect of organized labor on accounting in the U.S.

Chapter 3 presents the methodology of the study. Two samples of firms were used: the experimental sample—firms that were affected by the required disclosure, and a control sample of firms that were not affected by the legislation since they had voluntarily disclosed the required information prior to the legislation. Fifty firms were included in each sample. The matched sample design was intended to control for "other factors." The statistical methodology is in line with that generally employed by capital market accounting studies. The reader should be aware, however, that the empirical validity of the underlying constructs—the Capital Asset Pricing Model and the earnings generating processes—in Belgium has been researched less extensively than in the U.S. It is difficult to determine the effect of this limitation on the findings reported in the book.

Chapter 4 provided the empirical evidence. Information content was detected only for low-risk firms experiencing negative unexpected earnings. It seems then that except for these firms the Belgian stock market reaction to the 1976 Royal Decree was largely anticipatory. Or, alternatively, investors by and large ignored the new information. (This alternative is not suggested by the authors.)

The authors provide a reasonable explanation for the finding about the significant return and variance impact of the new information on stocks of firms with negative unexpected earnings. Namely, firms that have not complied voluntarily with the legislation prior to its enactment were, on the average, poor performers trying to hide their weakness. Hence, the mandated disclosure provided investors with new information on these firms.

A test for whether the systematic risk of stocks was changed by the new information (reported in Chapter 5) did not reveal evidence of such a change. Hence, the authors conclude the mandated disclosure did not have a significant impact on the systematic risk of the disclosing firms. No compelling economic explanation is given for this finding.

In evaluating the contribution of this book one should note that it deals with an important subject—information content of a new and extensive accounting legislation. The empirical tests are carefully and thoroughly conducted and the findings are clearly stated. This book is a worthwhile addition to the increasing stock of country studies in accounting. Teachers and researchers in international accounting and finance will find this book interesting and useful.

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NORMAN B. MACINTOSH, *The Social Software of Accounting and Information Systems* (Chichester, England; New York; Brisbane; Toronto; and Singapore: John Wiley and Sons, 1985, pp. xvi, 294, $29.95).

Technical issues concerning accounting and information systems have been extensively discussed in the literature. Furthermore, the behavioral aspects of accounting and information systems have been a frequent topic in scholarly journals and books of readings. However, this book is the first major attempt to bring together into a coherent framework the "peopleware" of accounting and systems.

The book's title, despite its halo, does not do justice to its nature and content. It should be described as the behavioral and organizational aspects of accounting information systems. Part one discusses the "Personal Aspects of Accounting and Information Systems"; part two the "Interpersonal Aspects"; and part three its "Future Directions." The book is very readable and should be of great interest, both as a reference as well as a support reading for an accounting information systems course.

The author makes a commendable effort in reviewing and examining literature of several subfields of accounting, in particular, budgeting, human information processing, accounting in organizations, the sociology of accounting, management control systems, individual differences, and the relationship between accounting and the environment. The chapters in the early part of the book (parts one and two) provide a thorough review of the relevant literature, selecting important research results and then linking and interpreting these findings (at times in a very liberal vein). The very interesting interpretations of this research are richly painted by the opinions of the author and often include anecdotal evidence which may be of value when covering the material in class. The emphasis in part three is on interpretation and analysis instead of literature review.

The book's focus is on accounting, not MIS or computer sciences literature and accounting academics and professionals are its natural audience. The book is notable because it is highly recommended, *both* for the use in courses and for its purely intellectual content. However, students should be told that the author's opinions sometimes color his conclusions. This fact also makes the book fascinating reading.

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PAUL B. W. MILLER and RODNEY J. REDDING, *The FASB: The People, the Process, and the Politics*, Second Edition (Homewood, IL: Richard D. Irwin, Inc., 1988 [1986], pp. xvi, 160, $7.95 paper).

Introductory and intermediate accounting texts rarely devote adequate attention to the process of accounting standards setting. Usually, the subject is addressed only in a graduate seminar and many students seem to get through the accounting program with a rather hazy idea about the sources of GAAP and, more particularly, its consensual basis. As the authors correctly point out:

> Some also seem to think that the standards-setting activity is simply a search for a "best" answer by a cold, logical analysis of the issues from an ivory tower; in fact, by its nature, standards setting is very much a matter of *politics* (p. xi).

Miller and Redding's book is a welcome addition to the literature. Those who would like to provide to their students a little more meat about the process of accounting standards setting can now refer to a handy and reliable source.

The book consists of five chapters dealing with various issues relating to the process of accounting standards setting. The introductory chapter attempts to indicate how the FASB gets involved in various accounting issues using selected excerpts from the popular financial press. The impression created is that the FASB is more reactive than comprehensive in its approach to standards setting. This view is moderated by a more holistic image in chapter five which discusses the Conceptual Framework. Putting chapter five at the beginning of the text would improve its organization.

Chapter two is an informative tour of the FASB, emphasizing the people who work for this organization. The short biographical sketches and pictorial representation of the members and staff should certainly capture the imagination of those who would like to know more about the FASB. Chapter three on due process procedure is reasonably detailed and well-written. However, one issue needing more discussion is the effects of agenda setting on FASB standards. Chapter four, which deals with some recurring accounting issues, can be easily integrated in an intermediate accounting course where problems such as accounting for income taxes, changing prices, and off-balance sheet financing are discussed. Finally, the Epilogue discusses some important issues such as the structural changes in the FASB —the role of the Emerging Issues Task Force— and the dominance by preparers versus auditors. These could have been brought into the main body of the text.

One weakness of the book is its reluctance to integrate the empirical research focusing on the process of accounting standards setting. For example, chapter one dealing with the relationship between financial reporting and capital markets makes only cursory reference to empirical research. Also, there are empirical studies drawing on economic theories of regulation and organizational theories that address issues related to the due process procedure and behavioral aspects of FASB decision-making. Although the deemphasis of relevant empirical research could make the book accessible to a wider audience, it limits the appeal of the text.

Overall, Miller and Redding have done an excellent job of providing a general background to the process of accounting standards setting. I plan to use the book as a supplementary reading for my financial accounting course.

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Shane Moriarity and Julie H. Collins, Editors, *Contemporary Tax Research* (Norman, OK: Center for Economic and Management Research, 1988, pp. i, 165, $15.00 paper).

This book is a collection of six papers presented at a conference at the University of Oklahoma in October 1987, together with the discussants' comments on those papers. Each of the papers is an empirical piece of tax research and each paper has two discussants; one from academia and one from a Big Eight public accounting firm. The papers include:

1. "A Conceptual Model of Factors Influencing Tax Preparers' Aggressiveness" by Valerie Milliron.
2. "Using the IRS Database for 1982 to Examine the Marriage Penalty Before and After TRA86" by Rebecca Kaenzig, Caroine Strobel, and Elchanan Cohn.
3. "The Impact of Tax-Favored Retirement Savings on Net Savings" by Julie Collins and James Wyckoff.
4. "An Analysis of the Effect of the 1983 Social Security Amendments on Individual and Family Equity" by Edmund Outslay.
5. "Participation in Individual Retirement Accounts: A Theoretical and Empirical Investigation" by Cherie O'Neil and G. Rodney Thompson.
6. "Some Evidence on the Effects of Tax Credits on the Demand for Risky Assets" by Charles Swenson.

Milliron's paper uses a modified delphi technique and factor analysis to analyze questionnaire data obtained from 12 Big Eight firm partners and managers. Her objective was to find those factors which influence tax preparers to take aggressive positions on behalf of their clients. Although the words "conceptual model" are contained in the paper's title, the model does not seem to be well developed.

Kaenzig, Strobel, and Cohn's paper may be called a "what if" exercise. They use 1982 Individual Tax File (Arthur Young database) to confirm the existence of the "marriage penalty" as it would have been in 1986 under various assumptions concerning allocation of nonwage income and deductions and use the same data and same assumptions to ascertain the extent of the "marriage penalty" under the 1988 tax law. Under all assumptions, the results confirm the obvious fact that there is a "bonus" for filing a joint return when the wages of the spouses differ greatly. The bonus decreases and becomes a penalty as the difference in wages decreases. Professor Sally Jones provides an excellent discussion of this paper. She properly points out that all of the data analysis of the paper was not necessary to demonstrate the existence of a marriage penalty. A simple mathematical formula would have been sufficient. She also points out that it is impossible to design a tax system that is progressive, horizontally equitable, and marriage neutral.

Collins and Wyckoff examine the issue of whether tax deferred retirement savings (IRAs, tax deferred compensation accounts, pension plans) increase net savings. Using multiple regression analysis they found that, in general, individuals do not reduce other savings when they invest in IRAs or tax deferred compensation accounts and they reduce other savings on the order of $0.16 to $0.25 for every $1 invested in pension plans. Although there is no economic theory presented in the paper, the results are consistent with the idea that individuals will increase savings as they become more tax favored relative to consumption.

Outslay's paper projects social security tax payments and benefits to the years 2029 and 2031 to determine the extent to which taxpayers who contribute higher amounts into the system will receive higher expected benefits and the extent to which future generations' payments will be used to pay benefits of current contributors. He finds that (1) individuals who retire in the future are expected to receive lower social security benefits than those who are currently retired, and (2) married couples where both spouses pay the maximum social security tax are expected to receive the lowest relative level of benefits.

O'Neil and Thompson's paper begins with a basic graphical analysis of consumption versus savings given that savings are first, taxed as ordinary income and second, preferentially. The empirical part of the paper then tests whether marginal tax rates of individuals (among other variables) are correlated with contributions to IRAs. Logit analysis is used. The data come from the panel files of the Arthur Young database. They find a strong positive association between increasing marginal tax rates and IRA contributions, which supports the graphical analysis, and a strong negative association between single individuals and IRA contributions. Professor Sylvia Madeo provides an excellent discussion of this paper. Her remarks address the paper's motivation, development of hypotheses from the theoretical analysis (or lack thereof), and use of data.

Swenson uses an experimental economics approach to examine the effects of offering a tax credit on investments in risky assets. His hypotheses are that (1) the demand for risky assets will be greater when a credit is offered than when it is not offered, and (2) the competitive equilibrium price of the risky asset will be greater when the credit is offered than when it is not offered. The results of his experimental market study confirm his hypotheses. Professor Gary Carter gives very thorough comments on the paper. Swenson offers a reply to Carter's comments, the only reply contained in the book. Both the comments and the reply make for interesting reading, especially for those interested in experimental economics.

It is interesting to note that although the research methodologies of the papers differ, the subject matter is rather narrowly focused. Five of the papers are explicitly concerned with individuals. None is concerned with other types of taxpayers. Two papers deal with tax deferred savings and contain some overlap. Furthermore, except for Swenson, the papers show little "cross fertilization" with the types of research and the research paradigms used by nontax accounting and other researchers.

It also should be noted that, in general, the practitioners' comments on the papers focus on the papers' conclusions and the practitioners' own anecdotal evidence concerning the papers rather than on the papers' methodologies. This is to be expected given the type of training practitioners have received.

Generally, the book, or some of the papers contained in it, should be interesting reading for those who want to get some sense of the "state of the art" of empirically based tax research. Such readers might include Ph.D. students, tax researchers, and those nontax researchers who are interested in collaborating with a tax researcher on a tax research project.

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THEODORE M. PORTER, *The Rise of Statistical Thinking: 1820–1900* (Princeton University Press, 1986, pp. xii, 353, $35.00 cloth, $12.50 paper).

Porter discusses the "rise of statistical thinking" during the nineteenth century in a wide range of scientific domains; biological, physical, and social. His goal is described by the following passage taken from the introduction:

> The statistical tools used in the modern sciences have virtually all been worked out during the last century. The foundations of mathematical statistics were laid between 1890 and 1930, and the principal families of techniques for analyzing numerical data were established during the same period. The achievement of the founders of mathematical statistics (Pearson, Spearman, Yule, Gosset, Fisher, and others) was formidable, and is justly venerated by their scientific heirs. There is, however, another story to be told, of the background that made this burst of statistical innovation possible. The development of statistics was necessarily preceded by its invention. This was the contribution of the nineteenth century, the culmination of a tradition of statistical thinking that embraced writers from a variety of backgrounds working in areas which were otherwise unconnected.

Porter's account traces the sociological and cultural sources which formed the background for the development of mathematical statistics as well as many disciplines which use statistical methodologies (e.g., physics, genetics, medicine).

The author demonstrates the connection between various natural and social scientific domains through common statistical principles. He examines major philosophical and political ideas which were associated with the development of statistics and related areas of science during the nineteenth century (e.g., statistical laws for aggregates versus individual free will). By telling us about statistical thinking during the nineteenth century in the social sciences (associated with, e.g., Quetlet, Graunt, Malthus, Corrite, and Buckle), in the physical sciences (associated with, e.g., Maxwell, Boltzman, and Peirce), in psychology (e.g., Fechner, Ebbinghaus), in population genetics (e.g., Galton, Pearson), and in other fields, Porter is actually telling a much wider story of the history of science in the nineteenth century.

The book is divided into four parts. The first part, entitled "The Social Calculus," has three chapters. "Statistics as Social Science" is the title of the first chapter. It portrays the shift from the eighteenth century use of statistics as a mean to preserve and enhance the power of government (king, nobility, or church) to the more democratic view in the nineteenth century where the ultimate beneficiaries would be the citizens of a dynamic society guided by statistical arithmetics. The second chapter on "The Laws that Govern Chaos" discusses two topics: (1) the main attempts during the nineteenth century to establish scientific social laws ("social physics") by the use of statistical arithmetics; and (2) how statistics and "social physics" emerged as supporting liberal politics. "From Nature's Urn to the Insurance Office" is the title of Chapter 3, where the evolution of the interrelations between the concepts of subjective probability and frequentist probability is discussed. The second part has two chapters. Chapter 4 is on the use of the normal distribution in several problems in "art and nature" during the eighteenth and nineteenth centuries. Chapter 5 is devoted to similarities between the social and natural sciences that occupied the minds of some "social physicists."

Part three, "The Science of Uncertainty," contains two chapters on statistics and free will and statistical uncertainty in physics and philosophy. The two chapters in part four deal with the evolution of mathematical statistics and biometrical statistics.

This is a wonderful book on the attempts of some great minds to uncover principles that govern social phenomena (i.e., find social statistical laws similar to scientific laws in the natural sciences), the evolution of statistical concepts in the natural sciences, and the evolution of probability theory and mathematical statistics as related to regularities of statistical frequencies.

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ROBERT R. STERLING, *An Essay on Recognition* (Sidney: The University of Sydney, Accounting Research Center, 1985, pp. 90).

A shout that tore Hell's concave, and beyond
Frightened the reign of Chaos and old Night (John Milton, *Paradise Lost*, Book 1, lines 542–543).

This monograph possesses many intriguing features, not the least of which is a glimpse into behind-the-scene politics at the FASB. Some may find this distracting, others will enjoy the added spice; however, every serious student of accounting should be concerned over the apparent preempting of logic by myopia garbed in "conventional wisdoms."

The short volume consists of a preface, acknowledgements, six chapters, and an appendix. Five chapters are concerned with two connected but distinct subjects and may be divided into two main parts: concepts and recognition tests. Chapter 1 states the immediate goals and long-run purpose. Next is an elaboration and refinement of Concepts Statement 1, 2, and 3 and emphasizes 2. Chapter 3 examines concepts that should come prior to the derivation of the recognition tests. The fourth chapter sets forth tests for recognizing the primitive elements of assets and liabilities. Chapter 5 focuses on equity and establishes the link between its definition and its existence as being dependent "...entirely on the prior recognition of assets and liabilities" (p. 6). The final chapter sets forth the recognition tests for financial change elements, comprehensive income, investments and distributions, and other elements not yet adopted by the FASB.

The preface contains a provocative discussion of how "representative faithfulness" has been "backseated" along with an entertaining description of "fun and games" at the FASB. The goals and long-run purpose are then enumerated:

- To contribute to accounting thought and thereby...to the deliberations of the FASB (p. 4).
- To stimulate research on and thinking about the subject of recognition (p. 4).
- To establish concepts to assist scholars and practitioners in making recognition decisions and to guide the FASB in setting standards for recognition of the elements and magnitudes to be displayed on financial statements (p. 4).

This work is important in several respects. First, it exposes some crucial errors in the logic underlying the establishment of accounting concepts. Second, it reveals the thought process of a theoretician in identifying the essence of an issue. Third, it discloses the frustrations that innovators encounter in an environment where truth is the first casualty. Finally, it highlights the dangers of a monastic state of mind, which views every recommendation as an insidious scheme of a heretic to infiltrate and desecrate the sacred halls of the status quo. For example, Sterling attributes the following quote to a member of the FASB: "just as I see a communist beneath every bush, I see current values beneath his every word" (Preface).

Throughout the work many traditional beliefs and old arguments are analyzed and restated in such a way that readers may wonder why they too had not detected their fallacies. For example, the debate over the tradeoff between "relevance and reliability" is shown to be unfounded. Both are necessary for decision usefulness; and, because there is "no evidence" that the magnitude of an attribute affects its relevance or reliability, the rule of cost or market should be eschewed. "Prudence...can not require substituting an irrelevant attribute for a relevant one or an unreliable attribute for a reliable one" (p. 54).

Throughout this essay the reader is challenged by passages such as:

> Historical costs are not the same as past prices in most instances (p. 38).
>
> One of the obstacles to improving the historical cost system is the tenacity of demonstrably erroneous ideas about cost (p. 49).
>
> Articulation...listed as "issue one" by the FASB (Issues, par. 25). The issue is stated there...as if the FASB were free to decide whether financial statements should articulate (p. 57).
>
> Faithful representation requires that if phenomena articulate then financial statements must articulate...(p. 57).
>
> A part of...the articulation debate is the conflict between...the revenue-expense view and...the asset-liability view....The LIFO-FIFO question ...the most telling example of the conflict because LIFO results in a good income statement and bad position statement....Those...who want both good income and position statements suggest abolishing articulation (pp. 58-59). [Sterling suggests three paragraphs later that the problem is the confusion of measurement with calculation (p. 60).]

At times there is the temptation to view statements "out of context" and to challenge their validity. This is typified by two statements:

> ...the present price of a receivable—the amount of cash received if factored without recourse—as opposed to a discounted or otherwise adjusted forecast of the amount that will be collected. Similarly for numerical depiction of an obligation arising from a lawsuit....Again what is sought is the present price of that obligation—the premium that would be charged by Lloyds to indemnify the entity—not a discounted or otherwise adjusted forecast of the payment at the conclusion of the trial (p. 55).

Here, one may question Sterling's abrupt dismissal of the discounted value of receivables and payables. However, he has covered himself in an earlier statement (p. 52) maintaining that the definition of cash equivalent (CE) establishes which attribute is to be measured and leaves it up to the measurer to apply it in the variety of instances that arise.

This monograph should be required reading for MS and Ph.D. students, academicians, and practitioners. It has much to say. For example, the discussion concerning noncost acquisitions, difficulty of measuring "sacrifice," and consideration of "favorable acquisitions," should cause the revision of some textbooks. However, the work is not easy reading. The lengthy analogies and insufficient use of accounting-directed illustrations may cause readers to lose sight of the argument and impede understanding. Analogies pose other dangers. Failure to specify or highlight all conditions may undermine rather than shore up the argument. For example, the navigation analogy (pp. 33–35) is at risk mainly because the author failed to emphasize the constraints.

In some instances the arguments and exposition, as typified by the CE debate mentioned earlier, would benefit from further refinement and consolidation. Furthermore, while the validity of some passages may be questioned, those so identified had no impact on the argument or the theme of the monograph and in most instances could be resolved by reflection.

To many this essay will present a new view of accounting "theory." To critics of GAAP it will provide powerful ammunition. For all it should encourage careful reexamination of the three Concepts Statements and the role of the FASB.

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NEW BOOKS: AN ANNOTATED LISTING

Editor's Note: As a general policy, books received but not reviewed in this or future issues will be annotated. There will be some exceptions.

ROBERT BRUCE, BRUCE MCKERN, IAN POLLARD, and MICHAEL SKULLY, *Handbook of Australian Corporate Finance*, Second Edition (Sydney, Australia: Butterworths, 1986, pp. xviii, 458, Aus. $35.00 paper).

Handbook examines the Australian financial market with a focus on the acquisition of funds by corporations. Twenty chapters are divided into five parts: the role of the financial institution in the economy; sources of equity capital—mergers and acquisitions, stock exchanges, the capital structure of Australian firms, and raising equity; various sources of debt funds in Australia, including domestic sources of long-term debt, leasing, accounts receivable, trading and merchant bank finance, accounts receivable and inventory finance, and project finance; the international financial system, sources of funds, financing trade, and foreign exchange; and several issues of importance to corporate takeovers: future markets, options, taxation, and corporate reconstructions.

Chapters are contributed. Robert Bruce is Lecturer in Management, Graduate School of Management, Macquarie University; Bruce McKern is Professor and Director, Graduate School of Management, Macquarie University; Michael Skully, Senior Lecturer in Finance, University of New South Wales.

THE CANADIAN INSTITUTE OF CHARTERED ACCOUNTANTS, *Accounting and Financial Reporting by Junior Mining Companies* (Toronto: The Canadian Institute of Chartered Accountants, pp. 63, Can. $25.00 paper).

Report defines a junior mining company as one whose principal activity is the acquisition and exploration of mining claims in efforts to determine the extent of mineralization. Objective of report is to identify potential accounting difficulties specific to such companies, explore accounting issues of particular relevance, discuss disclosure and financial statements, and consider specific auditing issues. Among the topics covered in the 11 chapters are resource acquisition accounting methods; exploration and development expenditures; accounting for disposal of mineral properties by abandonment or sale; current disclosure practices; attributes of the title recording systems in use in Canadian and U.S. jurisdictions; accounting for administrative costs; share capital presentation and transactions; flow-through shares; and audit considerations. The Appendix provides a review of current reporting practices of 115 mining companies.

Research was conducted by a five-member Study Group: R. D. Wheeler, R. J. McDonald, R. E. Tulk, H. K. Hawes, and R. Kay.

THE CANADIAN INSTITUTE OF CHARTERED ACCOUNTANTS, *Audit of a Small Business* (Toronto: The Canadian Institute of Chartered Accountants, pp. 73, Can. $13.50 paper).

Examines difficulties particular to the audit of a small business, and provides a practical guide for auditors of small businesses. Team examines: the effect of internal controls on the audit; the relevance of previous findings on the conduct of a small business audit; identification of common problems encountered in small business audits; and development of questionnaires and checklists useful to the practitioner. After an introductory chapter, the book examines the potential conflict of the auditor-as-advisor in the auditor-client relationship of a small business; the issue of auditability, focusing on the completeness assertion and management override of established procedures; controls in the small business environment; audit risk and audit assurance; and the issue of appropriate documentation and its development for the audit approach as advocated by this study. Six appendices provide practical checklists and questionnaires for the practitioner.

MARCELLO DE CECCO, *Changing Money: Financial Innovation in Developed Countries* (Oxford and New York: Basil Blackwell Ltd., 1987, pp. vii, 329, $45.00).

Collection of papers by authors drawn from academia, law, and business, on the changing profile of money and credit in developed countries, from a conference held in 1985 at the European University Institute. Editor's introduction on financial innovation and monetary theory is followed by: Albert M. Wojnilower, "Financial Change in the United States"; Meyer Eisenberg, "The Current Status of the Regulation of Financial Services and Products in the United States: Developments and Trends"; Donald D. Hester, "On the Empirical Detection of Financial Innovation"; Meghnad Desai and William Low, "Measuring the Opportunity for Product Innovation"; John H. Forsyth, "Financial Innovation in Britain"; Hermann-Josef Dudler, "Financial Innovation in Germany"; Cesare Caranza and Carlo Cottarelli, "Financial Innovation in Italy: A Lop Sided Process"; Christian de Boissieu, "Lessons from the French Experience as Compared with Some Other OECD Countries"; Yoshio Suzuki, "Financial Innovation in Japan: Its Origins, Diffusion, and Impacts"; and Enrica Guglielmotto and Giuseppe Passatore, "The Private Ecu Market: A Case of International Financial Innovation."

Marcello de Cecco is Professor of Monetary Economics at the University of Siena, and Professor of Economics at the European University Institute.

PHILIP L. COCHRAN and STEVEN L. WARTICK, *Corporate Governance: A Review of the Literature* (Morristown, NJ: Financial Executives Research Foundation, 1988, pp. 74, $5.00 paper).

Five chapters and two appendices focus on corporate governance—an umbrella term for numerous issues related to interactions among senior management, boards of directors, shareholders, and others. Each chapter makes reference to the relevant literature. Chapter 1, "Overview of Corporate Governance," defines corporate governance, examines its foundations, and explores demarcations between management and governance. Chapter 2, "Board Attributes" reviews conceptual and empirical findings on board composition, board size, age of members, outside versus inside directors, and compensation and other incentives. Chapter 3, "Responsibilities of Boards and Duties of Directors" examines evolving committee structures, expanding responsibilities, and emerging issues related to board. Chapter 4, "Professionalism, Corporate Legitimacy, and Corporate Crime" is concerned with codes of conduct and includes a discussion on why corporations are likely to engage in illegal activities. Chapter 5, "Concluding Comments" provides a summary and conclusion, and serves as an introduction to two bibliographic appendices.

Philip L. Cochran is Associate Professor of

Business Administration and Director of the Center for Issues Management Research at the Pennsylvania State University. Steven L. Wartick is Associate Professor of Business Administration and a faculty associate of the Center for Issues Management Research at the Pennsylvania State University.

NANCY W. COLLINS, SUSAN K. GILBERT, and SUSAN H. NYCUM, *Women Leading: Making Tough Choices on the Fast Track* (Lexington, MA: The Stephen Greene Press, Inc., 1988, pp. xv, 179, $17.95).

An informal look at the rewards and difficulties faced by women in successful high-level business careers. Authors draw on their own experiences as well as a sample of 160 women listed in *Who's Who of American Women*. A sampling of the topics covered in the seven chapters that comprise the book include: a look at some of the different personalities and challenges women face on the job, from discrimination to inspiring one's subordinates; personal relations outside of the job and the impact of a career on those relationships; family life—the husbands of superachievers—what kinds of men they are and why the marriages work; and the difficulties, joys, and disappointments of having children. The chapter entitled "Ambitions for the Future" focuses on three areas: equal salary and status for comparable work, the elimination of prejudice and chauvinism, and greater political strength.

Nancy Collins is the assistant to the president at the Palo Alto Medical Foundation; Susan K. Gilbert is chief operating officer of Apprise, Inc.; and Susan H. Nycum is a senior partner in the law firm of Baker & McKenzie.

T. E. COOKE, *European Financial Reporting: Sweden* (London: Institute of Chartered Accountants in England and Wales, 1988, pp. 201, £15.95 paper).

A comprehensive analysis of regulations affecting Swedish company accounts and the business environment. Intended to enable a reader with a U.K. accounting background to understand and interpret the accounts of Swedish companies. Book places its study of financial reporting methods within the context of Sweden's historical and present economic background; identifies the types and format of Sweden's business organizations including the role of the government in business; gives a brief description of the tax system; and reviews Swedish accounting practices and compares them to those in the U.S., U.K., and other European countries.

The report is both a technical document and a research report. Research data is taken from a survey of 90 corporate reports, selected from a listing of Sweden's top 2,000 companies. The survey was designed to analyze prevalent financial reporting methods in use in Sweden. Seven appendices include: extracts from the accounts of a major Swedish company shown in both English and Swedish; a summary of official accounting statements and recommendations (majority in Swedish); a brief comparison of reporting methods in Sweden versus the U.S., U.K., and other Scandinavian countries; audit report examples; and Swedish/English and English/Swedish glossary of accounting terms.

T. E. Cooke is a lecturer in accounting and finance at Exeter University.

THE GLOBECON GROUP, LTD., *Electronic Data Interchange and Corporate Trade Payments* (Morristown, NJ: Financial Executives Research Foundation, 1988, pp. 96, $6.00).

Study examines the history, current trends, potential benefits, and other issues surrounding the use of Electronic Data Interchange (EDI) and a type of Electronic Funds Transfer (EFT) known as Corporate Trade Payments. In general terms, EDI encompasses all routine business transactions accomplished through computer-to-computer communication including invoices, receipts, purchase orders, shipment notices, and transfers of funds. Fund transfers which rely on computer interchange rather than paper documentation are known collectively as EFT. Among the issues addressed in the study include: who is using EDI and how pervasive is its use; whether EDI will completely replace paper transactions between buyers and sellers as the primary business transaction method; why EDI is expanding and how do its users benefit; what the effects are of EDI on audits and controls; what the relationship is between EDI and just-in-time manufacturing; how EDI affects the relationship between the buyer and the seller; and what the internal effect of EDI is on the corporation. Appendix A deals with "EDI in the Business Transaction Cycle" and provides a schematic and narrative explanation of information exchanges that could be accomplished with EDI. Appendix B covers "Data Interchange Standards" and is a summary of the data developed by the American National Standards Institute in response for the need for uniform standards for the interindustry electronic interchange of business transactions. Appendix C contains survey results from a questionnaire of EDI. Appendix D is a glossary of terms used in connection with EDI. Appendix E lists the 66 contributors to the study.

JOSEPH T. KASTANTIN, *Professional Accounting Practice Management* (New York; Westport, CT; and London: Quorum Books, 1988, pp. 215, $45.00).

Purpose is to provide CPAs with advice on managing, expanding, and upgrading their practices. The first part of the book discusses the importance of determining specific business goals and limitations and also considers standard business policy regarding liability insurance, employment contracts, financing methods, and the termination of a business. Part Two is concerned with the development of successful working relationships with staff, partners, bankers, and the Internal Revenue Service. Part Three covers client servicing and provides guidelines on management concerns relating to auditing, review and compilation, tax practice, management and advisory services, and client write-up services. Part Four shows how the professional can market the firm and increase clientele. The final section examines some longer term operational aspects of the company such as computers, financial statements, and projecting budgets.

Joseph T. Kastantin is an Instructor of Accounting at the University of Wisconsin–La Crosse.

LOUIS E. V. NEVAER and STEVEN A. DECK, *The Management of Corporate Business Units* (New York; Westport, CT; and London: Quorum Books, 1988, pp. xv, 231, $39.95).

Book stresses importance of assessing the economic and political environment in planning portfolio strategies and managing subsidiaries and divisions in the international market. Work is divided into three parts: identification of problems; solution recommendations; and case studies which illustrate effectiveness of the recommendations. In Part I, authors present and analyze the key events which have led to the shifts in balance of international corporate power since World War II, and problems that beset corporate America. A review of standard portfolio management strategies is undertaken within this historical context, and underlying flaws are identified. The second part offers solutions to overcome difficulties in managing business units, with emphasis on using the Dow Jones Index as a broad-based economic indicator. Solutions for addressing inherent difficulties in portfolio planning are then introduced. Part II ends with a case study of Digital Equipment Corporation. Part II presents a systematic approach to portfolio management. Discussion emphasizes the importance of establishing internal structures that optimize corporate resources and discusses the tools needed to succeed in the present competitive environment. Louis V. Nevaer is Director of Political Analysis at International Credit Monitor. Steven A. Deck is Executive Director of Data and Statistics at International Credit Monitor.

GILLIAN M. SPOONER and EMIL M. SUNLEY, *The Corporate Tax Burden in the United States* (Morristown, NJ: Financial Executives Research Foundation, 1988, pp. 34, $5.00 paper).

Study reviews effects of recent tax legislation on the corporate sector. Examines the current level of the tax burden, anticipated future changes, and causes for the changes. Topics include: the effect of the Tax Reform Act of 1986; a comparison of corporate taxes in 1980s to earlier periods; an analysis of corporate income tax relative to GNP; the federal income taxes large corporations pay; the taxes corporations pay in addition to corporate income tax; and a comparison of the corporate tax rates to individuals' rates. Data for the report have been gathered primarily from national income and product accounts published by the Bureau of Economic Analysis in the U.S. Department of Commerce.

Gillian M. Spooner is with Touche Ross and Emil M. Sunley is with Deloitte Haskins & Sells.

SRI INTERNATIONAL, *Investor Information Needs and the Annual Report* (Morristown, NJ: Financial Executives Research Foundation, 1988, pp. viii, 101, $20.00).

Primary objective is to provide an understanding of individual and professional investors' information needs, and the role the annual report plays in conveying that information. Intended to assist both the investor interested in disclosure of information that affects corporate securities, and the issuer of the annual report to improve communications with investors. Based on investor interviews and surveys, study analyzes who the investors are, their information needs, what information sources are available to them, their perception of the annual report as a source of information, and what changes would improve the annual report. Through similar research with corporate officers, study analyzes the objectives of the report, perceived target audience, intended uses of the report, importance of specific sections, credibility as perceived by corporate executives, and importance of report's readability and physical appearance. Concludes with a discussion of the future of the annual report, how it is evolving, and how it can be improved. Four appendices provide information on research methods and results of surveys and interviews.

SRI International (formerly Stanford Research Institute) is headquartered in Menlo Park, California and is best known for its research and consulting. The report was researched and written by a project team from SRI's Financial Services Center.

Editor's Note: Heidi Cunnick assisted the editor in annotating these books.

BOOKS RECEIVED FROM MAY 27, 1988 TO SEPTEMBER 16, 1988

LYNDA LEE ADAMS-CHAU, *The Professionals' Guide to Fund Raising, Corporate Giving, and Philanthropy* (New York; Westport, CT; and London: Quorum Books, 1988, pp. xii, 167, $39.95).

RICHARD M. ALTMAN, *Creating Investor Demand for Company Stock: A Guide for Financial Managers* (New York; Westport, CT; and London: Quorum Books, 1988, pp. xv, 398, $45.00).

ROBERT N. ANTHONY, *The Management Control Function* (Boston, MA: The Harvard Business School Press, 1988, pp. ix, 216, $30.00).

AUSTRALIAN ACCOUNTING RESEARCH FOUNDATION, *Accounting Standards Board and Public Sector Accounting Standards Board, Proposed Statements of Accounting Concepts* (Caulfield, Australia: Australian Accounting Research Foundation, 1987, unpaginated).

ROBERT E. BENNETT, JAMES A. HENDRICKS, DAVID E. KEYS, and EDWARD J. RUDNICKI, *Cost Accounting for Factory Automation* (Montvale, NJ: National Association of Accountants, 1987, pp. xi, 70, $11.95 paper).

CALLIE BERLINER and JAMES A. BRIMSON, Editors, *Cost Management for Today's Advanced Manufacturing* (Boston, MA: Harvard Business School Press, 1988, pp. xvi, 253, $30.00).

ROBERT BRUCE, BRUCE MCKERN, IAN POLLARD, and MICHAEL SKULLY, *Handbook of Australian Corporate Finance*, Second Edition (Sydney, Australia: Butterworths, 1986, pp. xviii, 458, Aus. $35.00 paper).

ARDIS BURST and LEONARD A. SCHLESINGER, *The Management Game* (New York: Penguin Books, 1988, pp. 274, $8.95 paper).

THE CANADIAN INSTITUTE OF CHARTERED ACCOUNTANTS, *Audit of a Small Business* (Toronto: The Canadian Institute of Chartered Accountants, pp. 73, Can. $13.50 paper).

THE CANADIAN INSTITUTE OF CHARTERED ACCOUNTANTS, *Accounting and Financial Reporting by Junior Mining Companies* (Toronto: The Canadian Institute of Chartered Accountants, pp. 63, Can. $25.00 paper).

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T. E. COOKE, *European Financial Reporting: Sweden* (London: The Institute of Chartered Accountants in England and Wales, 1988, pp. 201, £15.95 paper).

J. M. COURT, *Audit and Control in a Microcomputer Environment* (London: The Institute of Chartered Accountants in England and Wales, 1988, pp. vii, 79, £9.95 paper).

MARCELLO DE CECCO, *Changing Money: Financial Innovation in Developed Countries* (Oxford and New York: Basil Blackwell Ltd., 1987, pp. vii, 329, $45.00).

F. S. DODD, *The Taxation of Specialised Bodies* (London: Chartac Books, 1988, pp. xvii, 387, £27.50 paper).

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MICHAEL GIBBINS and ALISTER K. MASON, *Professional Judgment in Financial Reporting* (Toronto: The Canadian Institute of Chartered Accountants, 1988, pp. 223, Can. $34.50 paper).

THE GLOBECON GROUP, LTD., *Electronic Data Interchange and Corporate Trade Payments* (Morristown, NJ: Financial Executives Research Foundation, 1988, pp. 96, $6.00 paper).

LOUIS GOLDBERG, *Dynamics of an Entity: The History of the Accounting Association of Australia and New Zealand* (St. Lucia, Australia: Accounting Association of Australia and New Zealand, 1987, pp. vii, 301).

ANDREW S. GROVE, *One-on-One with Andy Grove: How to Manage Your Boss, Yourself, and Your Coworkers* (New York: Penguin Books, 1988, pp. 235, $7.95 paper).

J. PHILIP HARDMAN and PAUL ESSEX, "A Practical Guide to Social Security Contributions 1988/89" *Accountants Digest* (London: The Institute of Chartered Accountants in England and Wales, 1988, pp. 61, £7.50 paper).

H. G. HEYMANN and ROBERT BLOOM, *Decision Support Systems in Finance and Accounting* (New York; Westport, CT; and London: Quorum Books, 1988, pp. xiv, 195, $39.95).

M. A. HINES, *Marketing Real Estate Internationally* (New York; Westport, CT; and London: Quorum Books, 1988, pp. viii, 239, $39.95).

M. A. HINES, *Guide to International Real Estate Investment* (New York; Westport, CT; and London: Quorum Books, 1988, pp. viii, 348, $49.95).

Joseph T. Kastantin, *Professional Accounting Practice Management* (New York; Westport, CT; and London: Quorum Books, 1988, pp. 215, $45.00).

RONALD J. KUDLA, *Voluntary Corporate Liquidations* (New York; Westport, CT; and London: Quorum Books, 1988, pp. 160, $35.00).

C. J. MCNAIR, WILLIAM MOSCONI, and THOMAS NORRIS, *Meeting the Technology Challenge: Cost Accounting in a JIT Environment* (Montvale, NJ: National Association of Accountants, 1988, pp. xx, 280, $33.95 paper).

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LOUIS E. V. NEVAER and STEVEN A. DECK, *The Management of Corporate Business Units* (New York; Westport, CT; and London: Quorum Books, 1988, pp. xv, 231, $39.95).

C. W. NOBES and R. H. PARKER, *Comparative International Accounting*, Second Edition (New York: St. Martin's Press, Inc., 1988, pp. xvi, 383, $24.95 paper).

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Paul L. Gerhardt, Executive Director

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Semiannual Publication of The Academy of Accounting Historians

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JANUARY 1989 PLACEMENT ADS

The deadline for information to be included in the "Placement Information" section is two months prior to the date of publication. The REVIEW *is published on the first day of January, April, July, and October. Placement advertising and replies should be sent to the American Accounting Association, 5717 Bessie Drive, Sarasota, FL 34233. ATTENTION: ADVERTISING DEPT. All replies to box numbers should be on separate sheets to facilitate forwarding. There is no charge for this service to AAA members and associate members seeking employment. Others will be charged a fee of $150 per insertion. ADS SHOULD NOT EXCEED 150 WORDS.*

#101 CALIFORNIA STATE UNIVERSITY, SACRAMENTO has accounting faculty openings, effective August, 1989, in its accredited AACSB undergraduate and master programs. Salary and rank open, commensurate with academic preparation and professional experience. For tenure-track positions, applicants must hold a doctoral degree with specialization in accounting; professional experience and/or certification are desirable. Primary emphasis is on teaching effectiveness; research and scholarly activities are required. Applicants in final stages of doctoral study may be considered for nontenure-track positions that may be converted to tenure-track if the doctorate degree is completed during the term of appointment. Send applications letter and resumé to Chair, Department of Accountancy, School of Business and Public Administration, California State University, 6000 J Street, Sacramento, CA 95819-2694. The Department will begin to review applications on Friday, September 30, 1988 until each position is filled. CSU, Sacramento is an Equal Opportunity/Affirmative Action/Handicapped/Title IX/Vietnam ERA Veteran Employer.

#102 THE UNIVERSITY OF MICHIGAN-FLINT has openings for tenure-track faculty positions at all ranks starting in either September or January. Most interest areas can be accommodated, although preference will be given to candidates in auditing and accounting information systems. Professional certification is desirable. Responsibilities include quality teaching, research, and service. Candidates must have a doctorate or be in the last stages of ABD. Salary is competitive and fringe benefits are excellent. Candidates should send a resumé to: Dr. Kristen Skivington, School of Management, The University of Michigan-Flint, Flint, MI 48502-2186. Applications accepted until position is filled. AA/EOE.

#103 KANSAS STATE UNIVERSITY seeks applicants for a probable position at the rank of Assistant, Associate, or Full Professor. Ph.D., D.B.A. preferred. Doctoral candidates within one year of completion will be considered for appointment at the Assistant Professor level. Appointment at Associate level requires five or more years of postdoctoral experience and significant publications. Appointment at the Full Professor level requires eight or more years of postdoctoral experience, a very significant publication record, and a strong national reputation as a researcher, teacher, or practitioner. Appointment at the Full Professor level may carry with it a title and supplemental funding as a designated Professor. Applicants must specify the level for which they wish to be considered and will not be considered for appointment at other levels. Final review of applicants will begin February 1, 1989. Kansas State University, Department of Accounting, Calvin Hall, Manhattan, Kansas 66506. Affirmative Action, Equal Opportunity Employer.

#104 THE SCHOOL OF PROFESSIONAL ACCOUNTANCY, UNIVERSITY OF SOUTHERN MISSISSIPPI, invites nominations and applications for the position of research professor. A distinguished research record and other academic qualifications that merit appointment at the rank of professor are required. Salary and other support will be highly competitive. The incumbent will be expected to continue productive research and to help develop the research potential of other faculty. Teaching load will be no more than nine hours per year. The SPA is a unit of the College of Business Administration which is AACSB-accredited. Contact: Director, SPA, Hattiesburg, Mississippi 39406-5178. AA/EEO.

#105 CHAIRPERSON, Department of Accounting, University of Nevada, Las Vegas. There are 14 faculty, 600 undergraduate majors; MS and MBA Programs. Applicants must have an earned doctorate in accounting from an AACSB accredited school and a record of recent and continuing research appearing in national publications. Demonstrated ability to provide academic and administrative leadership to a growing accounting department is desirable. Send resumé, letter of application, and three letters of reference to: Dr. W. T. Cummings, College of Business and Economics, University of Nevada, Las Vegas, Las Vegas, Nevada 89154. Review of applications will begin on October 1, 1988 and continue until position is filled. AA/EEO employer.

#106 GEORGIA INSTITUTE OF TECHNOLOGY, COLLEGE OF MANAGEMENT. Applications are invited for tenure-track faculty positions, beginning in September, 1989, at the level of assistant professor in the area of Accounting. Candidates should have strong research prospects and be capable of effective teaching at the graduate and undergraduate levels. Applications should include a current vita, references, and copies of completed research papers or material relating to the dissertation. Send applications to Professor Arnold Schneider, College of Management, Georgia Institute of Technology, Atlanta, GA 30332. The Georgia Institute of Technology is an equal opportunity/affirmative action employer.

#107 BOSTON COLLEGE is seeking applications for appointments at the Assistant or Associate levels in Accounting. Applicants for Assistant should possess a Ph.D. or D.B.A. ABD's will be considered. Applicants for Associate must have a proven record in teaching, research, and service. Boston College places a high emphasis on quality teaching. In addition, applicants will be expected to engage in scholarly research and will be supported in their efforts. The School of Management is AACSB accredited. Boston College is an Equal Opportunity/Affirmative Action Employer. Contact: Dr. Ronald Pawliczek, Department of Accounting, Fulton 400, Boston College, Chestnut Hill, MA 02167.

#108 CHAIRMAN, DEPARTMENT OF ACCOUNTING AND FINANCE, WEST GEORGIA COLLEGE. The School of Business invites applications for the position of Chairman, Department of Accounting and Finance. The Department currently has 11 faculty members and 400 majors in the two programs. The School is accredited by AACSB. Contact: Chairman of Search Committee, Department of Accounting and Finance, West Georgia College, Carrollton, GA 30117. West Georgia College is an Equal Opportunity, Affirmative Action employer.

#109 UNIVERSITY OF MARYLAND (COLLEGE PARK) invites applications for a faculty position in Accounting. The minimum qualification for Assistant Professor is a Ph.D. degree. A candidate for Associate or Full Professor should have a distinguished publication record and a record of quality teaching. Interested candidates should send resumés to Professor Lawrence A. Gordon, College of Business and Management, University of Maryland, College Park, MD 20742. The University of Maryland is an equal opportunity/affirmative action employer. Women and minorities are encouraged to apply.

#110 BUSINESS ADMINISTRATION—Tenure-track position for 1989–1990, preferably at assistant or associate professor level; Ph.D. or D.B.A. required for tenure consideration. Teaching responsibilities to include undergraduate accounting courses. Candidates should enjoy teaching, relate well to students and appreciate mission of a liberal arts college. Numerous opportunities for research, internship supervision, and consulting in nearby Dallas. Send dossier (transcript(s) and at least three current letters of recommendation) by November 1 to Dean David Jordan, Austin College, Sherman, Texas 75091. EOE.

#111 WAYNE STATE UNIVERSITY, Department of Accounting, invites applications for tenure-track positions as Assistant or Associate Professor. Earned Doctorate required (those completing dissertation will be considered for Lecturer positions). Evidence of excellence in teaching, research, and professional activities is necessary. Candidates will be expected to teach undergraduate and graduate classes in Auditing, Financial, Cost, Tax, or Data Base Information Systems. The School of Business Administration is accredited by AACSB. Wayne State University is an affirmative action/equal opportunity employer. Respond to: Dr. Alan Reinstein, Chairman, Department of Accounting, School of Business Administration, Wayne State University, Detroit, MI 48202. (313) 577-4530.

#112 THE JOHN M. OLIN SCHOOL OF BUSINESS AT WASHINGTON UNIVERSITY invites applications for positions in Accounting. Rank is open. A demonstrated potential for high quality research is required for appointment at the Assistant level while appointment at a higher rank will require an established research record. Applications must include a curriculum vitae, names and addresses of at least three references, thesis proposal or completed thesis, or copies of research papers or publications. An equal opportunity/affirmative action employer. Contact: James T. Little, Associate Dean for Academic Affairs, John M. Olin School of Business, Washington University, One Brookings Drive, St. Louis, MO 63130. Applications should be received by February, 1989.

#113 LOUISIANA STATE UNIVERSITY, Department of Accounting, anticipates faculty openings for the Fall of 1989. Available openings are at the assistant, associate, and full ranks. Assistant candidates should have a doctorate or be near completion of their doctoral program. Applicants at the upper ranks must have a commensurate research and professional service record. Faculty are generally expected to teach six hours per semester and be actively involved in research and professional service. The University is an Equal Opportunity/Affirmative Action Employer. Please send resumés and references to: Dr. Vincent C. Brenner, Chairman, Department of Accounting, College of Business Administration, Louisiana State University, Baton Rouge, LA 70803.

#114 RIDER COLLEGE invites applications for a tenure position in the Department of Accounting. Competitive salary with attractive balance between teaching and research expectations. Minimum qualification is a Ph.D. or D.B.A. in accounting, but consideration will be given to ABD on fast track. Accounting courses are offered at the graduate and undergraduate level by a full-time faculty of 14. Rider is a medium-size, private college with a highly regarded accounting program. Send vita to: Professor Larry Bailey, Department of Accounting, 2083 Lawrenceville Road, Lawrenceville, NJ 08648. Rider College is an equal opportunity, affirmative action employer, M/F/H.

#115 ACCOUNTING. Full-time permanent faculty (financial and auditing), graduate and undergraduate courses, Fall, 1989. PhD or DBA required. ABD considered. Research or scholarly writing essential for promotion and tenure. Rank open—preference to Assistant Professor. Salary is competitive. A land-grant University located in a progressive city of 80,000+. Applicants should submit a resumé, transcript, and three letters of recommendation to: Dr. Terry L. Lantry, Interim Chairman, Department of Accounting and Taxation, Colorado State University, Fort Collins, CO 80523. Application deadline February 28, 1989. Search may be extended until filled. Position contingent on the availability of funds. An Equal Opportunity, Affirmative Action employer.

#116 TAX. Full-time, permanent faculty (financial and tax), graduate and undergraduate courses, Fall, 1989. PhD or JD, MBA (Accounting concentration), CPA; PhD or JD, LLM (Tax), CPA with solid tax publication record. ABD considered. Teaching continuing education courses in taxation experience desirable. Research/scholarly writing essential for promotion and tenure. Rank open. Preference to Assistant Professor. Salary competitive. A land-grant University in a progressive city of 80,000+. Submit resumé, transcript, and three letters of recommendation to: Dr. Terry L. Lantry, Interim Chairman, Department of Accounting and Taxation, Colorado State University, Fort Collins, CO 80523. Deadline February 28, 1989. Search may be extended until filled. Position contingent on availability of funds. An Equal Opportunity, Affirmative Action employer.

#117 TEACHING POSITION WANTED. DBA, CPA, 22 years of university teaching experience. Numerous book and article publications. Teaching areas: undergraduate cost/managerial and financial accounting; graduate accounting theory and accounting research methodology. Seek full-time, tenure-track position. Available June, 1989.

#118 SAMUEL CURTIS JOHNSON GRADUATE SCHOOL OF MANAGEMENT, CORNELL UNIVERSITY has a position opening for an Assistant, Associate, or Full Professor of Accounting. Responsible for teaching basic and advanced courses in accounting at the Master's level; research in area(s) of expertise and interests; supervision of doctoral candidates; and interdisciplinary contribution to the research and teaching of other faculty members. Direct inquiries to: Professor Dale Morse, S. C. Johnson Graduate School of Management, 520 Malott Hall, Cornell University, Ithaca, New York 14853. Applicants should have completed a doctorate or be at the dissertation stage of a doctoral program. Applications should include a vita, together with a dissertation proposal or abstract, and copies of research papers. An Affirmative Action/Equal Opportunity Employer.

#119 CENTRAL MICHIGAN UNIVERSITY has one or more faculty openings for the 1989-90 academic year. While all areas are encouraged to apply, the primary needs are in tax, managerial, and systems. Ph.D. or near completion is required, professional certification is desirable. Rank is open depending on qualifications. Competitive salary with excellent benefits. Maximum of nine-hour load per semester; summer teaching and research opportunities available. Excellent working and living environment. Undergraduate business programs are AACSB accredited. Contact: Philip L. Kintzele, Chairman, Department of Accounting, Central Michigan University, Mt. Pleasant, MI 48859. CMU is an AA/EO institution; all parties are invited to apply.

#120 RUTGERS UNIVERSITY'S SCHOOL OF BUSINESS-CAMDEN invites applications from highly qualified candidates for tenure-track positions in Auditing and Financial Accounting. Rank and salary are commensurate with qualifications and experience. Research support is extensive. Normal teaching load is six hours per semester. Senior faculty members are encouraged to apply. Rutgers-Camden is located across the Delaware River from Philadelphia. Expected completion of new Business Building January 1989. Contact: Ira S. Greenberg, Assistant Dean, Rutgers University-Camden, School of Business, Camden, NJ 08102 or call (609) 757-6216.

#121 THE AMERICAN UNIVERSITY IN CAIRO seeks an Assistant, Associate, or Full Professor of Accounting to teach, in English, principles of accounting, auditing, managerial accounting, and accounting for planning and control in the undergraduate business administration and/or graduate management programs. Ph.D. and teaching experience required. Two-year appointment (renewable) begins September 1989. Rank, salary according to scale based on qualifications and experience. For expatriates, housing, air travel, and partial school tuition for dependents included. Write, with resumé, to: Dean of the Faculty, The American University in Cairo, 866 United Nations Plaza, Suite 517, New York, NY 10017, preferably before February 15, 1989.

#122 TENURE-TRACK POSITIONS IN ACCOUNTING. Rutgers, The State University of New Jersey, Department of Accounting in Newark invites applications for tenure-track positions in the following areas: Financial, Managerial, Governmental/Social. Positions carry appointments at the Assistant/Professor levels, reduced teaching load and modest advisement and other departmental responsibilities. We are particularly interested in applicants who are committed to careers in teaching and can demonstrate ability in (or potential for) outstanding research and publication. The Department has adequate resources to support such interests and activities. Applicants should have an earned doctorate in an appropriate field of study (ABD status may be acceptable), experience in teaching and accounting practice, and a professional certificate/license. Salary and benefits competitive. Travel support, research assistants, and compensated annual leaves available. Submit full curriculum vitae to Dr. David J. Zaumeyer, CPA, Chairman, Department of Accounting, 214 Bradley Hall, Newark, New Jersey 07102. Rutgers is an Equal Opportunity/Affirmative Action Employer.

#123 TENNESSEE TECHNOLOGICAL UNIVERSITY invites applications for a tenure-track accounting position beginning Fall 1989. Applicants with interests in Auditing and Accounting Systems will be given some preference but interests in all areas will be accommodated. All our programs have the general business and separate accounting AACSB accreditation. Assistant, Associate, and Full Professor ranks are invited to apply. Doctorate and appropriate level of scholarly achievement is required for senior levels, but promising ABDs will be considered at entry level. Professional certification is a plus. Salary is competitive with AACSB-accredited public universities. Position open until filled. Send resumé to Professor G. A. Swanson, Chairperson, Department of Accounting and Business Law, College of Business Administration, P.O. Box 5024, Tennessee Tech University, Cookeville, TN 38505. TTU IS AN AFFIRMATIVE ACTION/EQUAL OPPORTUNITY EMPLOYER.

#124 THE UNIVERSITY OF MARYLAND European and Asian Divisions seek excellent teachers for undergraduate courses on U.S. military bases overseas. Minimum requirements include a master's in accounting, one year of recent college teaching experience, and U.S. citizenship. Renewable annual appointments begin August 1989. Excellent for a sabbatical or leave of absence. Benefits include transportation and military base privileges. Frequent travel and the cost of schooling make these positions difficult for those with children. Send resumé to Dr. Ralph E. Millis, The University of Maryland University College, College Park, MD 20742-1642. AA/EEO.

#125 Professor of Accounting and Business Finance, currently Dean of Faculty, seeks Visiting Professorship in a reputable University. Nearly 20 years undergraduate/postgraduate quality teaching/research experience with impressive publications. Will respond to all genuine enquiries. Available any time from August 1989.

#126 ROCHESTER INSTITUTE OF TECHNOLOGY invites applications for Department Chair of Accounting & Finance. Candidates must have an appropriate doctorate and a strong teaching and publication record. Administrative experience desirable. Salary and benefits are competitive. RIT is a privately endowed, coeducational university serving 14,000 students in suburban Rochester, New York, home to a full range of cultural, educational and social activities, and a high technology industrial base. The College of Business is AACSB accredited, has approximately 1,900 undergraduate and graduate students, and 42 faculty. The Department consists of 15 tenure-track positions. Send applications to: Dr. Bruce L. Oliver, Department of Accounting & Finance, RIT, College of Business, Rochester, NY 14623. EOE/AA.

#127 ROCHESTER INSTITUTE OF TECHNOLOGY invites applications for tenure-track faculty positions. Candidates seeking Assistant positions should have an appropriate doctorate or be near completion, Associate/Full candidates must also possess strong publication records. Salary and benefits are competitive. RIT is a privately endowed, coeducational university serving 14,000 students in suburban Rochester, New York, home to a full range of cultural, educational and social activities, and a high technology industrial base. The College of Business is AACSB accredited, has approximately 1,900 undergraduate and graduate students, and 42 faculty. Send applications to: Dr. Bruce L. Oliver, Department of Accounting & Finance, RIT, College of Business, Rochester, NY 14623. EOE/AA.

#128 DBA, CPA, nine years of university teaching and research. Numerous professional publications and presentations. Actively involved with both the academic and business community. Seeks administration/teaching position with a smaller quality institution. Areas of teaching are auditing/financial accounting. Available Spring, 1989 or Summer, 1989.

#129 CALIFORNIA POLYTECHNIC STATE UNIVERSITY-SAN LUIS OBISPO seeks candidates for September 1989 appointments in tenure-track faculty positions. Primary need is managerial/cost area; others considered. Doctorate required. Professional certification preferred. Candidates must be committed to teaching excellence and professional development including research and publication. Rank and salary commensurate with experience. Contact Dr. James Anderson, Accounting Department, School of Business, Cal Poly State Univ., San Luis Obispo, CA 93407. Closing date—February 15, 1989 or until filled. Cal Poly is an equal opportunity/affirmative action employer and only hires individuals lawfully authorized to work in the U.S.

#130 TARLETON STATE UNIVERSITY, part of the Texas A&M University System, is seeking Assistant/Associate Professor in Accounting for September 1, 1989. Ph.D./D.B.A. in accounting preferred, A.B.D. considered. Salary for nine-month contract is competitive/negotiable, normal fringe benefits provided, summer teaching usually available. Tarleton has an enrollment of approximately 5,800 students, approximately 350 accounting/finance majors. Located in North Central Texas area, 60-100 miles SW of Fort Worth/Dallas. Applications due March 15, 1989. Contact Dr. Boyd Collier, Department of Accounting, Box T-459, Stephenville, TX 76402. 817-968-9910. AA/EOE,MF.

#131 CHAIRPERSON, COLORADO STATE UNIVERSITY, position available June 1989. Chairperson provides academic and administrative leadership for a 14-member College of Business department. College has full AACSB accreditation graduate and undergraduate levels. Chairperson has 10½-month contract. Teaching assignments include undergraduate or graduate-level courses. Must qualify for rank of full professor; Ph.D., DBA, or J.D. required; professional certification desirable; research and scholarly writing is expected as is commitment to excellence in teaching. Administrative experience preferably within a department of accounting. Salary open, competitive, based upon qualifications. Deadline February 28, 1989. Send resumé, three references, short statement of views of the role of department chairperson to Dr. R. V. Switzer, Department of Accounting and Taxation, Colorado State University, Fort Collins, CO 80523. AA/EOE.

#132 THE ITHACA COLLEGE SCHOOL OF BUSINESS seeks to fill two full-time, tenure-track faculty positions: (1) Assistant/Associate Professor of Accounting Information Systems, and (2) Assistant/Associate Professor of Accounting. Qualifications: Ph.D./D.B.A. or doctorate in a related field; active ABDs considered; professional experience desirable. Responsibilities include undergraduate teaching, scholarly research, and service to the College. Salaries are negotiable and competitive. The School of Business occupies new facilities, on a modern campus, overlooking Cayuga Lake and the City of Ithaca, a cosmopolitan community of about 30,000. Review of applications will continue until the positions are filled. Send vita, letter of interest, and three references (names, addresses, and telephone numbers) to: Dr. Hugh C. Rowland, Assistant Dean, School of Business, Ithaca College, Ithaca, NY 14850.

#133 NORTHWESTERN UNIVERSITY, Evanston, Illinois, invites applications for one or more tenure-track openings in accounting and information systems at the assistant, associate, and full professor levels available for September 1989 in the J. L. Kellogg Graduate School of Management. Candidate selection criteria include excellent teaching capability, outstanding potential for (or record of) superior research, and strong recommendations. We offer Master of Management and Ph.D. programs. Doctorate (or close to completion) is required. Send curriculum vita, transcripts, references, and dissertation proposal to: Professor Robert P. Magee, Department of Accounting & Information Systems, Kellogg Graduate School of Management, Northwestern University, Evanston, Illinois 60208. In order to ensure full consideration, application must be received by March 1, 1989. Hiring is contingent upon eligibility to work in the United States. Northwestern University is an Affirmative Action/Equal Opportunity Employer.

#134 UNIVERSITY OF NEW ORLEANS invites applications for the position of Assistant or Associate Professor of Accounting in systems, tax, or financial/managerial. Candidates should have the Ph.D. or DBA degree (will consider ABD). Evidence of excellence in teaching, research, and professional activities is necessary. Salary is negotiable and competitive. The University offers the M.S. in Accounting and the M.S. in Accounting (tax option), as well as the M.B.A. Approximately 550 undergraduate accounting majors are enrolled. The University has AACSB accreditation at both the undergraduate and graduate levels. Candidates should send resumé to Professor Gordon A. Hosch, Chairman, Department of Accounting, College of Business Administration, University of New Orleans, New Orleans, LA 70148. UNO is an Affirmative Action, Equal Opportunity Employer.

#135 THE UNIVERSITY OF SOUTH DAKOTA invites applicants for a tenure-track appointment in accounting. Rank and salary based on qualifications. Applicants should have PhD/DBA or be nearing completion. Primary teaching areas are cost and managerial accounting at undergraduate and graduate levels. The university, located in a rural setting, enrolls 5,800 students with 230 upper division accounting majors, 200 full- and part-time MBA students, and has small Master of Professional Accountancy program. Undergraduate and MBA programs are AACSB accredited. An equal opportunity/affirmative action employer. Send applications to: Dr. Phil Fisher, University of South Dakota, Vermillion, SD 57069.

#136 TOWSON STATE UNIVERSITY, DEPARTMENT OF ACCOUNTING, is seeking tenure-track positions beginning in the Fall, 1989 semester. Candidates must possess a doctorate with Accounting as major area, professional certification, and appropriate record of research and publications. The School of Business offers a B.S. in Accounting and is actively seeking AACSB accreditation for both business and accounting programs. Rank: Assistant or Associate Professor depending on academic credentials and experience. Salary: AACSB competitive. Send vita by February 15, 1989 to: Dr. Sam Barone, Dean, School of Business and Economics, Towson State University, Baltimore, Maryland 21204. Review of applicants is in process and will continue until position filled. Towson State University, located on a 326-acre campus in a northern suburb of Baltimore, is a liberal arts-based comprehensive university with an enrollment of approximately 15,000 undergraduate students, of which 4,000 are undergraduates in the School of Business and Economics. An Affirmative Action, Equal Opportunity Employer. Women and Members of Minority Groups encouraged to apply.

#137 DEPARTMENT CHAIR: TOWSON STATE UNIVERSITY, SCHOOL OF BUSINESS AND ECONOMICS. The Department of Accounting is seeking a chair commencing September 1, 1989. Chair provides leadership to 18 full-time faculty and should have an established record of teaching excellence, research, and service. The School of Business and Economics offers a B.S. in Accounting and is actively seeking AACSB accreditation for business and accounting programs. Candidates must possess a doctorate in Accounting. Candidates must be willing and able to maintain strong relationship with the professional accounting community and possess professional certification. Administrative experience desirable. Must possess credentials and research record to warrant appointment at the Associate or Professor level. Rank and salary AACSB competitive. Send vita by February 15, 1989 to: Dr. Sam Barone, Dean, School of Business and Economics, Towson State University, Baltimore, Maryland 21204. Review of applicants is in process and will continue until position is filled. Towson State University is an affirmative action, Equal Opportunity Employer.

#138 DEPARTMENT OF ACCOUNTING: Two tenure-track positions are available commencing Summer or September 1989. Applicants should possess a Ph.D., a D.B.A., or be ABD in accounting. Rank and salary depend on qualifications. The normal teaching load is 12 hours with two preparations but reduced teaching loads for research are available. Application deadline is February 28, 1989 or until the positions are filled. Send letter of application and resumé to: Chairperson, Accounting Department Search Committee, 325 Shippen Hall, Shippensburg University, Shippensburg, PA 17257. Shippensburg University is an Equal Opportunity/Affirmative Action Employer. Women and Racial Minorities are encouraged to apply.

#139 THE UNIVERSITY OF CENTRAL ARKANSAS is accepting applications for a tenure-track position in accounting beginning Fall 1989. Rank and salary are open depending upon qualifications. Ph.D. or DBA is preferred. ABD or Masters with CPA/CMA will be considered. UCA is AACSB accredited at the undergraduate level and is now seeking accreditation of MBA program. Application deadline is February 15, 1989 or until position is filled. UCA is an affirmative action/equal opportunity employer. Send resumés, transcripts, and names of three references to: Dr. Bill Humphrey, Chairman, Department of Accounting, UCA, P.O. Box 4982, Conway, AR 72032.

#140 DIRECTOR, SCHOOL OF ACCOUNTANCY, THE UNIVERSITY OF SOUTH FLORIDA invites applications from individuals with distinguished records of published scholarly research who are capable of providing leadership to strong professional undergraduate and graduate programs and to a developing new Ph.D. program. The University of South Florida is an equal opportunity, affirmative action employer. Recruiting to continue until the position is filled. Applications should be sent to: Dr. Jack L. Smith, School of Accountancy, University of South Florida, Tampa, FL 33620-5500.

#141 POSITION WANTED: PhD, CPA. Eighteen years experience, publications, good teacher. Prefer urban location. Available Fall, 1989.

#142 CHAIRPERSON—Department of Accounting, Southwest Texas State University. Position requires doctorate in accounting, a minimum of five years full-time teaching experience, and scholarly research. Academic or business administrative experience desirable. Responsibilities include program development, faculty recruitment, evaluation, and research support, and fostering of relationships with the profession. Salary for a 12-month appointment: Associate–$59,844; Full–$62,904 (1988 scale). Appointment: 9/1/89. Closing date: 2/15/89. The department, one of four in the School of Business, has 20 FTE faculty and approximately 500 students at junior-senior level. SWTSU has a student enrollment of almost 20,000 students and is the seventh largest institution of higher education in Texas. San Marcos is situated in the beautiful Central Texas Hill Country on 135 acres between Austin and San Antonio. Send vita, three letters of recommendation, and doctoral transcript to Chair Search Committee, Department of Accounting, Southwest Texas State University, San Marcos, Texas 78666.

#143 NORTHEASTERN ILLINOIS UNIVERSITY. Applications are invited for candidates with Ph.D./D.B.A. in accounting for the areas of auditing, management information systems, federal income taxes, and financial accounting. Tenure-track positions at assistant/associate rank. Teaching experience preferred. Must have commitment to research. Positions beginning January 1, 1989 or September 1, 1989, pending funding. Selection process begins immediately and continues until filled. Send resumés, transcripts, and names of three references to: Search and Screen Committee, College of Business and Management, Northeastern Illinois University, 5500 North St. Louis, Chicago, Illinois 60625. AA/EOE.

#144 LONGWOOD COLLEGE. The School of Business and Economics seeks applications for a faculty position in Accounting. A doctoral degree is preferred but ABD will be given serious consideration. We will support minority candidates with masters in their pursuit of a doctoral degree. Rank is open depending upon qualifications. Longwood College, a state supported school committed to excellence in teaching, has approximately 2,800 students including 755 majors in the various business programs. The College is located in Farmville, VA, 60 miles west of Richmond. Applications should be sent to Dr. J. D. Martin, c/o Employee Relations, Longwood College, Farmville, VA 23901. AA/EOE.

#145 ACCOUNTING. Tenure-track position beginning Fall 1989. Preference is given to candidates with the CPA and MBA/MS/MA in Accounting or with a doctorate. Outstanding candidates with only the CPA or with only the MS/MA in Accounting or who are near the dissertation stage will be considered. College teaching experience is desirable but not necessary. Candidates with a wide variety of areas of expertise will be considered; a background in taxation is desirable. Albright College is a highly competitive four-year liberal arts college in Southeastern Pennsylvania. Teaching load is six courses a year. Salary and rank commensurate with credentials and experience. Send letter and vita to Terence J. Reilly, Chairperson, Accounting Department, Albright College, P.O. Box 15234, Reading, PA 19612-5234. Albright College encourages minority and women candidates to apply. Review of resumés will begin December 1, 1988. AAEOE.

#146 INSEAD—The European Institute of Business Administration is seeking to expand its Accounting and Control Faculty. Expansion is required to meet the rapid growth of MBA and executive programmes and to respond to research opportunities. Career and visiting positions are available at all ranks. Conditions of employment are competitive and negotiable. There is a tenure system for senior faculty. Successful candidates will have or be completing a Ph.D. (or equivalent), have a proven track record, or show potential, for high quality research and teaching focused on positive accounting. Candidates should enjoy teaching and have the capacity to relate well to mature MBAs and senior executives of international corporations. The primary language of instruction is English. INSEAD is located in the historic town of Fontainebleau, surrounded by forests and within easy reach of Paris. Reply to: Deigan Morris, Area Coordinator, Accounting and Control Area, INSEAD, Boulevard de Constance, 77305 Fontainebleau Cedex, France.

#147 INDIANA UNIVERSITY-PURDUE UNIVERSITY AT FORT WAYNE invites applications for a tenure-track position at Assistant or Associate level in EITHER the financial or taxation areas. Salary is commensurate with qualifications and experience. Applicants should possess a doctorate in accounting or other appropriate terminal qualifications with evidence of excellence in research necessary for appointment at a senior rank. Preference will be given to candidates who demonstrate a commitment to teaching and an interest in professional activities. IPFW is located in a progressive mid-sized city and has AACSB accreditation at both the undergraduate and graduate levels. Candidates should send a resumé to Dyne L. Pfeffenberger, Chairman, Department of Accounting, IPFW, Fort Wayne, IN 46805. An equal opportunity, affirmative action employer.

#148 CHAPMAN COLLEGE. Two tenure-track positions for Fall 1989, Assistant/Associate levels. Ph.D. (ABD considered for assistant level), demonstrated excellence in teaching, and a commitment to scholarship required. Additional resources available to support a continuing level of high quality research. Salaries commensurate with qualifications and experience. Chapman College is a small, private liberal arts/pre-professional college located 30 miles south of Los Angeles. The School of Business and Management has 600 students at the undergraduate and graduate levels. Send curriculum vitae, evidence of qualifications, and three letters of reference by February 28, 1989 to: Dr. Raymond Sfeir, Associate Dean of School of Business and Management, Chapman College, Orange, CA 92666. AA/EO.

#149 FREEMAN SCHOOL OF BUSINESS-TULANE UNIVERSITY invites applicants in accounting. Rank open. Ph.D. in hand or near completion. Salary and teaching loads competitive. Senior candidates must have a strong research record. Junior candidates must have a strong research agenda. Quality teaching is expected. The Freeman School, located on the Uptown Campus of suburban New Orleans, has 40 tenure/tenure-track faculty members and 700 students in undergraduate and graduate programs. Tulane is an affirmative action, equal opportunity employer. Send vita and references to: Ronald C. Lease, Associate Dean, Freeman School of Business, Tulane University, New Orleans, LA 70118.

#150 THE UNIVERSITY OF TENNESSEE AT CHATTANOOGA invites applications for a tenure-track position beginning August 1989. Rank is open, based on qualifications and experience. Candidates should have a Ph.D. or DBA in Accounting with an interest in the tax systems or managerial area. The University places a balanced emphasis on teaching and research. The University has an enrollment of 8,000 students. The School of Business Administration has 1,600 undergraduate students and 250 MBA students. Applications should be sent to: Dr. John Fulmer, Head, Department of Accounting and Finance, University of Tennessee at Chattanooga, Chattanooga, Tennessee 37403. UTC is an equal opportunity/affirmative action employer.

#151 LYCOMING COLLEGE is seeking applicants for a full-time tenure-track position in Accounting. Ph.D. or D.B.A. preferred; CPA and Masters degree required. Evidence of teaching effectiveness with undergraduates expected. Rank and salary commensurate with qualifications. Submit letter of application, resumé, three letters of reference and transcripts to Mr. Richard Wienecke, Chairman, Department of Accounting, Lycoming College, Williamsport, PA 17701. Lycoming College is an Equal Opportunity Employer.

#152 THE UNIVERSITY OF BRIDGEPORT is seeking qualified applications for tenure-track faculty positions beginning September, 1989 to teach undergraduate advanced accounting and audit courses and financial, management, and information systems courses in the MBA and Master of Accountancy programs. Small class sizes. Earned doctorate in Accounting or near completion required. AACSB accredited. Apply to University of Bridgeport, Chair, Department of Accounting, Bridgeport, CT 06601.

#153 GRAND VALLEY STATE UNIVERSITY-THE ACCOUNTING AND TAXATION DEPARTMENT is accepting applications for faculty positions to teach at the undergraduate and graduate levels. Primary openings are in the Managerial, Financial, and the Tax area. ACCOUNTING: Rank is dependent upon qualifications. Salary is competitive. Excellent fringe benefits, research monies, and summer teaching opportunities. Qualified candidates should be able to demonstrate evidence of effective teaching, research competence, and community service. A doctorate or candidates in the final stages of their doctoral program will be considered. Please send a vita to: Dr. Donald J. Klein, CPA, CMA, Chairman, Department of Accounting and Taxation, Seidman School of Business, 244 Lake Huron Hall, Grand Valley State University, Allendale, MI 49401 or call (616) 895-2167. Grand Valley is an Equal Opportunity, Affirmative Action Employer.

#154 YORK UNIVERSITY, TORONTO seeks accounting faculty. Rank is dependent upon qualifications; salary and benefits are competitive. Candidates must possess a doctorate or be close to completion. Both effective teaching and quality publications will be expected. Contractually Limited Appointments are also available. York University is Canada's third largest university, and the Faculty of Administrative Studies contains the country's largest and most diverse MBA program. Other programs are a small honors BBA program and a Ph.D. program. In accordance with Canadian immigration requirements, preference will be given to Canadian citizens and permanent residents. York University is an equal opportunity employer. Send resumé to: Dr. L. S. Rosen, Faculty of Administrative Studies, York University, North York, Ontario M3J 1P3.

#155 GANNON UNIVERSITY—Two tenure-track positions available. Duties include teaching twelve (12) hours at the undergraduate level and graduate level in accounting, participate in the governance of the department and University, and student advisement. ABD or Ph.D. required. Salary open, dependent upon qualifications and experience. Starting date of September 1989. Applicants must provide letter of application, resumé, official transcripts, and letters of recommendation. Send all correspondence to: Cary F. Chludzinski, Chairman, Department of Accounting, Gannon University, University Square, Erie, Pennsylvania 16541. Gannon University is an equal opportunity/affirmative action employer.

#156 TAX PROFESSOR—Tax position desired by candidate with N.Y.U. LL.M., Yale J.D., Berkeley M.B.A., C.P.A. Substantial teaching experience and outstanding teaching evaluations.

#157 SOUTHEASTERN MASSACHUSETTS UNIVERSITY, College of Business and Industry, welcomes applications for two or more accounting positions in the Department of Accounting and Finance for September 1989. Candidates must have a Ph.D. or DBA with accounting major and proven or potential research capability. The College of Business and Industry is seeking AACSB accreditation, encourages minorities and women to apply, and will set rank and salary commensurate with qualifications. Resumés should be sent to Dr. Moustafa Abdelsamad, Dean, College of Business and Industry, Southeastern Massachusetts University, North Dartmouth, MA 02747, telephone (508) 999-8432. The University is an Affirmative Action/Equal Opportunity employer.

#158 PITTSBURG STATE UNIVERSITY is seeking faculty at the Assistant or Associate Professor rank. Ph.D. or DBA required. Candidates should have a strong interest in research and publication and effective teaching. Rank and salary depend upon qualifications and offers will be competitive. Will consider MBA/CPA for a one-year appointment. Pittsburg State University is located in southeast Kansas equidistant from Kansas City, MO and Tulsa, OK, and also close to the Missouri and Arkansas Ozark Mountains and lake recreational areas. Send vita by February 1, 1989 to Donald M. Cash, Chairman, Department of Accounting, Kelce School of Business and Economics, Pittsburg State University, Pittsburg, Kansas 66762. PSU is an equal opportunity, affirmative action employer.

#159 CALIFORNIA STATE UNIVERSITY, HAYWARD seeks applicants for assistant and associate professors in accounting (financial, managerial, cost, and auditing) for 1989-90. Salary level $33,660-$50,068, commensurate with qualifications. PhD (or ABD) required. Teaching effectiveness and research capabilities are important. Teaching assignments will include instruction at the undergraduate and/or graduate levels in a department that has an excellent reputation. Hayward is located across the Bay from San Francisco. Qualified candidates should send inquiries and resumés to Vernon Kam, Department of Accounting, California State University, Hayward, California 94542. The University is an Equal Opportunity/Affirmative Action Employer.

#160 CALIFORNIA STATE UNIVERSITY, Los Angeles, Department of Accounting, announces an opening for the position of Chair of the Department. Candidates should have the following qualifications: Eligibility for appointment to a tenure-track position at the Associate/Full professor level; earned doctorate in accounting, business administration, or a closely related field; demonstrated organizational and resource management abilities; and experience in teaching in a qualified accounting program. Research, professional publications, and presentations; activities within professional organizations; and involvement in university/college committee activities and community service are desirable. Salary is competitive. Interested candidates are invited to send their curriculum vita to: Dr. Hugh Warren, Chair, Search Committee, Accounting Department, School of Business and Economics, California State University, Los Angeles, 5151 State University Drive, Los Angeles, California 90032. (213) 343-2830. Deadline is March 1, 1989 or until filled. California State University, Los Angeles is an equal opportunity/affirmative action employer.

#161 CHRISTOPHER NEWPORT COLLEGE invites applications for one or more tenure-track positions in Accounting at the Assistant/Associate level beginning Fall, 1989. Preferred candidates will possess an appropriate terminal degree, but consideration will be given to those who are making progress toward such qualifications or who hold an MBA/CPA. Successful college teaching experience and a professional certification are highly desirable. Christopher Newport is a four-year state-supported college with nearly 5,000 students where research is encouraged, but quality teaching is emphasized. Please send a letter of application and vita to: Richard L. Hunter, Dean, School of Business and Economics, Christopher Newport College, 50 Shoe Lane, Newport News, VA 23606-2988. CNC hires U.S. citizens and aliens lawfully authorized to work in the U.S. An EEO/AA Employer.

#162 ACCOUNTING/INTERDISCIPLINARY STUDIES: Guilford College, Assistant Professor, tenure-track position beginning Fall 1989. Strong commitment to teaching undergraduates at a small liberal arts college; interest in financial accounting and in teaching and participating in the development of interdisciplinary courses. Doctorate and CPA preferred. Guilford is a selective, coeducational Quaker liberal arts college. Guilford College is an Affirmative Action/Equal Opportunity Employer. We actively seek applications from women and minorities. Send statement of interest and vita by February 15, 1989 to Dr. Anne Ponder, Acting Academic Dean, Guilford College, Greensboro, NC 27410.

#163 UNIVERSITY OF HONG KONG. Applications are invited for a Lectureship in Management Studies in the field of Comparative Marketing and International Marketing. Applicants should possess appropriate higher degrees and/or professional qualifications. Preference will be given to applicants with teaching and/or professional experience. Annual salary (superannuable) is on an 11-point scale: HK$200,340–334,860 (US $1 = HK $7.80). Starting salary will depend on qualifications and experience. At current rates, salaries tax will not exceed 15½% of gross income. Children's education allowances, leave, and medical benefits are provided; housing or tenancy allowances are also provided in most cases at a charge of 7½% of salary. Further particulars and application forms may be obtained from the Appointments Officer, Association of Commonwealth Universities, 36 Gordon Square, London WC1H OPF, or from the Appointments Unit, Registry, University of Hong Kong, Hong Kong. Applicants are additionally requested to provide, in respect of their major research area, a short descriptive title and a brief summary of the work they have undertaken and the direction in which their work is proceeding. Closes 31 January 1989.

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All manuscripts should be typed on one side of 8½ × 11″ paper and be double-spaced, except for indented quotations. Three copies should be submitted together with a check for $50.00 in U.S. funds or equivalent made payable to American Accounting Association. The author should retain a copy of the paper. Manuscripts should be as concise as the subject and research method permit, and in general, they should not exceed 7,000 words in length. Margins should be appropriate to facilitate editing and duplication. To assure an anonymous review, authors should not identify themselves directly or indirectly in their papers.

A cover page should show the title of the paper, the author's name, title, and affiliation, and any acknowledgments. An Abstract, of 150–250 words, should be presented on a separate page immediately preceding the text. The Abstract should be nonmathematical and include a summary of the research question, method, and principal findings. The style of the Abstract should be objective, without personal pronouns. The title of the paper, but not the author's name, should appear on the Abstract page and on the first page of the text. All pages, including tables, appendices, and References, should be serially numbered. The first section of the paper should be untitled and unnumbered. Major sections may be numbered in Roman numerals. Subsections should not be numbered.

When not in lists, numbers from one through ten should be spelled out, except where decimals are used. All others should be written numerically. Hyphens are preferred to the compounding or to the coining of words. Single authors should not employ the editorial "we."

A helpful guide to usage and style is *The Elements of Style*, by William Strunk, Jr., and E. B. White, published in paperback by Macmillan Publishing Co., Inc.

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Each table and figure should appear on a separate page, be placed at the end of the text, and bear an Arabic number and a title. A reference should appear in the text to each table or figure. The author should indicate by marginal notation where each table or figure should be inserted in the text. Tables and figures should be reasonably interpretable without reference to the text. Recent issues illustrate appropriate formats.

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Footnotes should not be used for literature citations; instead, the work should be cited by the author's name and year of publication in the body of the text, shown in square brackets, *e.g.*, [Givoly, 1985]; [Madeo and Pincus, 1985]; [Waller and Chow, 1985, p. 460]; [Porcano, 1984a; Staubus, 1985]. Citations to institutional works should employ acronyms or short titles, where practicable, *e.g.*, [AAA SATTA, 1977]; [AICPA Cohen Commission Report, 1977]; where brief, the full title of an institutional work might be shown in a citation, *e.g.*, [ICAEW *The Corporate Report*, 1975]. If an author's name is mentioned in the text, it need not be repeated in the citation, *e.g.*, "Ashton [1985, p. 174] says. . . ."

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Textual footnotes should be used only for extensions and useful excursions whose inclusion in the body of the manuscript might disrupt the continuity. Footnotes should be double spaced, numbered consecutively throughout the manuscript with superscript arabic numerals, and placed at the end of the text.

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Every manuscript must include a list of References containing only those works cited. Each entry should contain all of the data necessary for unambiguous identification. Titles of journals should not be abbreviated. The entries should be arranged in alphabetical order according to the surname of the first author. Institutions under whose auspices works without authors have been published should also be shown in the alphabetical order. Multiple works by the same author(s) should be listed in chronological order of publication. It is preferred to use authors' initials instead of proper names. Samples of entries are as follows:

American Accounting Association, Committee on Concepts and Standards for External Financial Reports, *Statement on Accounting Theory and Theory Acceptance* (AAA, 1977).

Sherman, H.D., Ed., *Conceptual Framework for Financial Accounting* (Harvard Business School, 1984).

Porcano, T. M. "Distributive Justice and Tax Policy," THE ACCOUNTING REVIEW (October 1984a), pp. 619-636.

———, "The Perceived Effects of Tax Policy on Corporate Investment Intentions," *The Journal of the American Taxation Association* (Fall 1984b), pp. 7-19.

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Manuscripts currently under consideration by another journal or other publisher should not be submitted. In the case of manuscripts reporting on field surveys or experiments, three copies of the instrument (questionnaire, case, interview plan, or the like) should be submitted. The mailing addresses of the Managing Editor (for Main Articles, Notes, and Comments), Book Review Editor, and the Small Sample Studies Editor are given at the conclusion of the Table of Contents.

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All contributors of potential Comments should first communicate directly with the author of the original article. The objective of this pre-submission step is to eliminate from the proposed Comment any misunderstandings, misconceptions, or other differences that would not warrant publication. Once the written exchange of views with the author has been completed, the Commentator may submit to the *Review* the residue of the proposed Comment, if substance remains. Three copies of the correspondence between the Commentator and the author of the original article should be submitted to the Managing Editor together with three copies of the manuscript. All other editorial norms, as enumerated above, also apply to proposed Comments.

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The Executive Compensation Effects of Equity-for-Debt Swaps

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ABSTRACT: This paper provides an analysis of the association between the accounting gain produced by an equity-for-debt swap and executive compensation. Our results suggest that the executives of firms completing a swap transaction experience an increase in cash compensation (salary plus bonus). The increase is largest both in absolute magnitude and in statistical significance for firms whose compensation plans are more "accounting-oriented" (i.e., firms whose executives would be expected to experience the greatest increase in compensation under the hypothesis that firm's compensation plan is not adjusted for the accounting gain produced by the swap). We also find that, on average, the value of the executives' personal equity holdings decreases in the period surrounding the announcement of the swap. The magnitude of this decrease is, on average, comparable in size to the increase in their compensation. However, there is some weak evidence that executives of firms whose compensation plans are more "accounting-oriented" experience a statistically significant increase in their total wealth (i.e., the sum of excess compensation and the value of personal equity holdings) as a result of the swap transaction.

ACCOUNTING research has directed increasing attention to the relations among accounting numbers, compensation plans, and managerial incentives (e.g., see Antle and Smith [1985, 1986], Dukes et al. [1980], Healy [1985], Holthausen [1981], Horwitz and Kolodny [1980], Lambert and Larcker [1985, 1987a, and 1987b], Larcker [1983, 1987], Larcker and Revsine [1983], and Watts and Zimmerman [1978]). In particular, researchers are beginning to examine whether compensation contracts with senior-level executives, which are often written explicitly on the basis of accounting numbers, are adjusted for the effects of managerial "manipulation" of earnings.[1] Evidence on this issue can provide insight into the factors that influence the selection of accounting numbers and the motivation of executives to engage in earnings manipulation.

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[1] Abdel-khalik [1985], Healy et al. [1987], and Simon [1983] analyze the compensation effects associated with a change from LIFO to FIFO, and Healy et al. [1987] examine the compensation effects associated with changes from accelerated to straight-line depreciation.

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In this paper, we analyze the relation between the earnings effects associated with an equity-for-debt swap (hereafter swap) and changes in executive compensation and wealth. In a swap transaction, an investment banking firm purchases previously issued corporate bonds that are selling at a discount, and exchanges them with the corporation for new equity shares. As with other types of corporate recapitalizations, relatively little is known about why firms engage in swaps. At the anecdotal level, Peavy and Scott [1985, p. 44] state that many financial analysts argue that "swaps are just an accounting ploy designed to boost earnings without increasing the firm's economic value." In particular, a swap transaction enables the corporation to report an accounting gain equal to the difference between the book value and the market value of the debt (adjusted for any transaction costs). The "earnings manipulation" aspect of swaps is also discussed in Sloan and Spragins [1981] and Anders [1982].

According to Finnerty [1985], the first swap occurred shortly after the enactment of the Bankruptcy Act of 1980, which allowed firms to avoid taxation on the accounting gain produced by extinguishing the debt. The accounting gain produced by a swap transaction was made taxable in the Tax Reform Act of 1984, and very few swaps occurred after this date. The timing of swaps relative to tax law changes suggests that swaps are at least partially motivated by tax considerations. However, even if the accounting gain is tax-free, it is not clear that repurchasing debt in order to report an accounting gain has any real economic benefits to the firm.

In fact, even though these recapitalizations produce a positive effect on accounting earnings, their announcement is associated with a security market reaction that is, on average, *negative* and statistically significant.[2] To the extent that a negative security price reaction constitutes evidence concerning the desirability of an action from the perspective of shareholders (which we discuss in more detail in Section IV), there is greater potential for a conflict of interest between managers and shareholders with swaps than for other accounting transactions (e.g., changes in inventory method or depreciation method). This suggests that swap transactions are potentially informative events for examining shareholder-manager conflicts.

Swap transactions are also interesting events because of the amount of information that is typically disclosed regarding these transactions. Specifically, the firms in our sample disclose that they have completed a swap transaction and report the magnitude of the swap's effect on accounting earnings in their annual report in the year in which the swap takes place. The disclosure of this information, which is similar to the information disclosed regarding voluntary changes in accounting methods, should make it easy, in principle, for shareholders to control any conflicts of interest with the managers that might arise regarding the desirability of swap transactions. For example, it would be relatively simple to remove the accounting gain produced by the swap transaction and base executive bonuses on the adjusted accounting earnings. In fact, Demski et al. [1984] suggest that managerial decisions that are observable by the shareholders (or the board of directors), such as accounting changes, swap transactions, or mergers, can be explicitly included in the terms of managerial compensation contracts. In this way, shareholders have the ability to preclude actions from being selected which, based on the information they possess, they believe to be contrary to their own interests.

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[2] There are many empirical studies that have examined the security market reaction to recapitalizations. At least five recent studies have analyzed large samples of swaps: (a) Finnerty [1985] estimates the cumulative excess return from day 0 to day +1 to be −1.19 percent, (b) Peavy and Scott [1985] estimate the cumulative excess return from day −5 to day +5 to be −1.84 percent, (c) Rogers and Owers [1985] estimate the cumulative excess return from day −1 to day 0 to be −1.29 percent for firms involved in a "refunding strategy" and −0.60 percent for the remaining firms, (d) Lys and Sivaramakrishnan [1987] estimate the cumulative excess return from day 0 to day +1 to be −1.11 percent, and (e) Hand [1987] estimates the cumulative excess return from day 0 to day +1 to be −1.30 percent. Moreover, each of these cumulative excess returns is statistically significant at conventional levels.

In this paper, we assess the impact of the increase in accounting earnings produced by the swap on the compensation and wealth of top-level executives. Our empirical results indicate that the executives of firms completing a swap transaction experience an *increase* in cash compensation (salary plus bonus). The increase is largest both in absolute magnitude and in statistical significance for firms whose compensation plans are more "accounting-oriented" (i.e., firms whose executives would be expected to experience the greatest increase in compensation under the hypothesis that the firm's compensation plan is not adjusted for the accounting gain produced by the swap). We also find that the value of the executives' personal equity holdings decreases in the period surrounding the announcement of the swap. The magnitude of the decrease in the value of their personal equity holdings is, on average, comparable in size to the increase in their compensation. However, there is some weak evidence that executives of firms whose compensation plans are more "accounting-oriented" experience a statistically significant increase in their "total" wealth (defined as the sum of excess compensation and the value of personal equity holdings) as a result of the swap transaction.

The remainder of the paper is divided into five sections. Section I describes the sample selection criteria and discusses some general characteristics of the sample. In Section II, we use data from the period prior to the swap to empirically estimate the relation between accounting earnings and executive compensation for each firm in our sample. In Section III, we analyze the excess compensation for executives in the year of the swap transaction. Section IV presents the results of the security market reaction to the swap announcement, the impact of the swap on the stock-related components of executive wealth, and the "total" effect of the swap on the executives' wealth. The study is summarized in Section V.

I. SAMPLE

A sample of swaps was developed from data provided by three investment banking firms and data on registrations of equity-for-debt transactions contained in the *Investment Dealer's Digest*. These sources produced an initial sample of 273 individual swap transactions. The following selection criteria were used to develop the final sample:

- compensation data (salary plus annual bonus) for the chief executive officer (CEO) must be available for the period from 1970 to the year of the swap,
- the effect of the swap transaction on annual earnings (hereafter, the swap gain) must be disclosed in the annual report, and
- data on earnings before extraordinary and discontinued operations and data on extraordinary and discontinued operations must be available on either the industrial or research COMPUSTAT file from 1970 to the year of the swap.

The application of these selection criteria produced a sample of 179 swap transactions from 1981 to 1984.[3] If a firm completed multiple swaps in a given year, we aggregated these swaps into a single observation and computed the total effect on earnings from swap transactions within the year. This approach is used because we have only *annual* compensation data for assessing the association between the accounting gain provided by the swap and executive compensation. This aggregation procedure reduced the sample size to 159 *firm-years* with swap transactions. There were 22, 76, 35, and 26 firms that engaged in swap transactions in the fiscal years ending in 1981, 1982, 1983, and 1984, respectively. There were 92 firms who completed swaps in only one of these years, 26 firms with swaps in two years, and five firms with swaps in three years. The sample includes firms engaged in durable manufacturing, nondurable manufacturing, banking, and regulated utilities. The firms in the sample are some of the largest public corporations in the United States. For example, the mean (median) market value of the common shares outstanding at the end of the fiscal year prior to the swap date was $1,902MM ($1,039MM).

Data on the accounting treatment and size of the swap gain are presented in Table 1. SFAS No. 4 generally requires that material gains that arise from the early extinguishment of debt be reported as extraordinary items. Panel A of Table 1 indicates that 107 of the 159 firms included the swap gain in *ordinary* income. Although this would suggest that the majority of the firms viewed the effect of the swap on net income to be immaterial, in many cases the earnings effect of the swap was nontrivial. For example, the mean (median) accounting gain produced by the swap is $11.5MM ($7.2MM), with a range from $0.0MM to $89.0MM. Moreover, panel B of Table 1 indicates that these gains had the effect of increasing net income by a mean of 8.0 percent and a median of 4.8 percent in the year of the swap.

The results in Table 1 suggest that firms are more likely to treat the swap gain as an extraordinary item as the gain becomes large relative to the earnings of the firm. Using a parametric two-sample t-test ($t=2.51$) and a nonparametric two-sample Mann-Whitney test ($z=5.15$), we can reject the hypothesis that the size of effect of the swap gain on net income is independent of whether the gain is included in ordinary income or treated as an extraordinary item. However, note that the swap transaction frequently has a nontrivial effect on reported earnings even for the firms that included the swap gain in ordinary income. For this set of firms, the median effect on net income was 3.9 percent, and one-fourth of these firms increased their net income by at least 6.8 percent via the swap transaction.

It is also of interest to examine the earnings performance of the sample in the year of the swap transaction. We compared the earnings in the year of the swap, excluding the swap gain, to the earnings number that would be expected assuming that the earnings process follows a random walk with a drift term (see Foster [1986] for a review of earn-

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[3] Hand [1987] reports that the total population of swaps over the period from 1981 to 1984 consists of 291 transactions. Therefore, our initial sample of 273 swaps is essentially equivalent to the population of these corporate recapitalizations. A total of 59 firms (with 65 swap transactions) were lost due to insufficient compensation data. For the most part, these were smaller firms whose compensation data from the early 1970s could not be obtained from proxy statements available to us. In addition, 15 firms (with 23 swap transactions) were eliminated because the annual report did not mention the effect of the swap transaction on accounting earnings. Finally, six firms were eliminated because of missing data on the COMPUSTAT file.

TABLE 1

DESCRIPTIVE STATISTICS FOR THE ACCOUNTING ASPECTS OF EQUITY-FOR-DEBT SWAPS (1981–1984)

Panel A. Treatment of Swap Gain:

	Number of Firms
Gain Treated as Ordinary Income	107
Gain Treated as Extraordinary Income	52

Panel B. Size of Swap Gain Relative to Net Income:[a]

	Total Sample	*Firms that Treated Swap Gain as Ordinary Income*	*Firms that Treated Swap Gain as Extraordinary Income*
n^b	142	99	43
Mean	0.080	0.054	0.139
Median	0.048	0.039	0.090
TMean	0.065	0.047	0.108
StDev	0.133	0.049	0.221
Max	1.484	0.274	1.484
Min	0.000	0.002	0.000
Q3	0.096	0.068	0.145
Q1	0.029	0.023	0.059

[a] The net income figure in the denominator of this ratio is net income without the swap gain. Firms with negative earnings in the year of the swap ($n=17$) are excluded.

[b] Notation: n = sample size, Mean = sample average, Median = sample median, TMean = trimmed mean (upper and lower five percent of observations removed), StDev = sample standard deviation, Max = largest observation, Min = smallest observation, Q3 = value corresponding to the upper quartile, and Q1 = value corresponding to lower quartile.

ings expectation models). For 95 (60 percent) of the firms, earnings before extraordinary items in the year of the swap (excluding the swap gain) was below the expectation, and for 96 (60 percent) of the firms, net income was below the expectation. Moreover, 17 (11 percent) of the firms had a net loss in the year of the swap.

To conduct significance tests, we standardized the earnings forecast error in the year of the swap for each firm using the standard deviation of its forecast errors from 1970 to the year prior to the swap. The mean (median) standardized forecast error for income before extraordinary items and discontinued operations was −0.44 (−0.41), with similar results for net income. If the standardized forecast errors for earnings are assumed to be independent, the unexpected decrease in earnings is statistically significant using both a parametric t-test and nonparametric Wilcoxon rank-sum test at the 0.01 level (two-tail). Due to time period and industry clustering, it is likely that the 159 observations exhibit some degree of positive cross-sectional correlation, which suggests that these significance levels are likely to be overstated. These results indicate that swaps tend to occur during years in which firms are experiencing adverse annual earnings performance relative to time-series expectation models.[4] This finding is consistent with the results in Lys and Sivaramakrishnan [1987], who examine annual earnings, and in Hand [1987], who examines quarterly earnings performance.

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[4] Given the research method discussed in Sections II and III, the relevant benchmark for earnings performance

II. ESTIMATION OF EXECUTIVE COMPENSATION CONTRACTS

Model of Executive Compensation and Accounting Earnings

The most direct means of assessing whether executive compensation contracts are adjusted for the effect of swap transactions on accounting earnings would be to obtain access to the precise form of the executives' compensation contracts. Unfortunately, there are a number of factors which prevent us from adopting this approach. Although approximately 95 percent of the firms in the sample report that their executive compensation contracts contain annual bonus plans that are based on accounting earnings, only 67 of the 159 firms (i.e., 42 percent) disclose the precise functional form of their bonus funding formulas in their proxy statements.[5] Moreover, almost all firms provide their compensation committees with the discretion to adjust the reported bonus formulas. Therefore, even if the bonus formulas do not explicitly state that they are adjusted for the effects of swap transactions or other accounting changes, the compensation committee may do so implicitly (see Antle and Smith [1985, pp. 313–314] for additional discussion of this issue).

Finally, the bonus formulas and the compensation data that are disclosed in proxy statements are for different groups of executives. This prevents the researcher from using the compensation data disclosed in proxy statements to determine whether the disclosed bonus formulas are implicitly adjusted. Proxy statements disclose only individual compensation data for the top five officers and for all officers and directors as a group. However, the bonus plans described in proxy statements are used to calculate a bonus *pool* that is shared among a much larger group of executives. Neither the aggregate compensation paid to this group nor the precise formula for allocating the bonus pool to individual executives or subgroups of executives is typically disclosed.

Because of the problems associated with using the bonus formulas described in proxy statements, an empirical model was developed of the relation between cash compensation (salary plus annual bonus) and earnings for each firm. In prior studies, some researchers have estimated the form of the relation between compensation and performance using

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is the time-series expectation model discussed in the text. However, it is also of interest to compare the earnings performance of the firms in our sample to the earnings performance of firms that did not engage in swap transactions. This information would be relevant, for example, for research studies that attempt to predict why some firms engage in swap transactions while other firms do not. To provide some evidence on this issue, the standardized forecast errors for the swap firms were compared to the standardized forecast errors for the *industry* portfolio composed of all firms on either the annual or research COMPUSTAT file in the same two-digit SIC code as the swap firm (again using an expectation model for earnings in the form of a random walk with a drift). The Wilcoxon matched-pairs signed-rank test was then applied to the swap firm's standardized forecast error and the corresponding forecast error for the industry portfolio for the year of the swap. The results provide weak evidence that the swap firms had more negative standardized forecast errors than their industry comparison group for earnings before extraordinary items and discontinued operations ($z = -1.622$, $p < 0.10$, one-tail) and for earnings after extraordinary items and discontinued operations ($z = -0.787$, $p > 0.10$, one-tail). Because both groups of firms appear to have been experiencing adverse earnings performance, it is unlikely that firms engage in swap transactions solely as a result of their adverse earnings performance.

[5] This percentage is slightly higher than that found in Healy [1985], who found that approximately 38 percent of the *Fortune 250* disclose the precise functional form of their bonus funding formulas in their proxy statements.

cross-sectional data (e.g., Abdel-khalik [1985, 1988], Adams [1987], and Ely [1987]), while other researchers have used time-series data (e.g., Antle and Smith [1986], Healy et al. [1987], and Lambert and Larcker [1987b]). Since the evidence in the latter group of papers suggests that the slope coefficients of compensation plans vary considerably across firms, and because the firms from the sample belong to a diverse set of industries, we have chosen to adopt the time-series approach to empirically estimating the relation between compensation and earnings.

We assume that cash compensation for firm i can be characterized by

$$(C_{it}-r_iC_{i,t-1})=a_i+b_i(E_{it}-r_iE_{i,t-1})+u_{it} \quad (1)$$

where

C_{it} = the cash compensation for firm i in year t,
E_{it} = the earnings for firm i in year t,
u_{it} = the random error (residual) for firm i in year t,
a_i and b_i = the regression parameters, and
r_i = the first-order autocorrelation coefficient.

The relation in equation (1) is a regression with an adjustment for first-order autocorrelation.[6] If the autocorrelation coefficient is equal to zero, the regression is equivalent to a regression of cash compensation on earnings in levels. If the autocorrelation coefficient is equal to one, the regression is equivalent to a regression of first differences in compensation on first differences in earnings. Note that equation (1) permits the parameters a_i, b_i, and r_i to be firm-specific.

As in Healy et al. [1987], Abdel-khalik [1985], and Simon [1983], we use cash compensation (i.e., salary plus annual bonus) as our measure of compensation in equation (1). Compensation data for the CEO (or top corporate executive) from 1970 to the year of the swap was obtained from proxy statements and the annual compensation surveys in *Business Week* and *Forbes*. In order to avoid the confounding effects of changes in the price level on the analysis of time-series data, the cash compensation and earnings numbers were converted to 1967 dollars by applying the relevant Consumer Price Index (CPI).

While cash compensation is not a complete measure of executive compensation, it is almost always a significant portion of total compensation.[7] Moreover, since bonus plans are frequently explicitly written in terms of accounting numbers, whereas other forms of compensation are not, we would expect cash compensation to be more sensitive to accounting numbers than would other forms of compensation.[8] This suggests that it may be easier to detect whether the accounting gain produced by the swap transaction is allowed to "flow through" the bonus contract than through the complete compensation contract.[9] In particular, if we find that firms go to the trouble of removing the effect of the swap gain on accounting earnings in determining their executive bonuses, we believe that it would be unlikely that they would make the executives "whole" by increasing another component of their compensation.

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[6] The relation between compensation and earnings expressed in equation (1) is similar to that estimated in Healy et al. [1987] with the following exceptions. First, our analysis uses the Cochrane-Orcutt procedure to adjust for serial correlation in the residuals, whereas the results reported in Healy et al. do not use this adjustment. However, Healy et al. note [p. 18] that they repeated their analysis using the Cochrane-Orcutt adjustment procedure and obtained similar results. We also found that our results were insensitive to whether the Cochrane-Orcutt method was applied. Second, our dependent and independent variables are compensation and earnings, respectively, while Healy et al. use the logarithm of compensation and the logarithm of earnings. Lambert and Larcker [1987b] provide evidence that suggests that the results of compensation studies are generally insensitive to whether logarithmic transformations are applied to the data.

[7] Cash compensation typically represent 70 to 80 percent of a CEO's yearly compensation (see Hay Associates [1981], Booz Allen & Hamilton [1985], and Murphy [1985]). Moreover, Jensen and Murphy [1987] provide some evidence that the slope coefficient relating cash compensation to performance (as measured by the change in the market value of the firm's stock) is not significantly different than the coefficient relating total compensation to performance. To our knowledge, there is no evidence regarding whether the slope coefficient on accounting performance would be significantly affected by the inclusion of other components of compensation.

However, if we find that firms do not adjust their cash compensation contracts for the accounting gain produced by the swap, we cannot be sure that there are no offsetting effects in the other components of compensation. For example, an examination of the proxy statements of the firms in our sample in the year of the swap indicated that 88.1 percent of the firms had stock option plans, 64.8 percent had stock appreciation rights, 18.9 percent had restricted stock plans, 54.1 percent had performance plans, and 5.7 percent had other performance-based plans. Unfortunately, the information disclosed about these plans is generally insufficient to allow us to determine the amount of compensation paid from these plans as a function of performance in any particular year.[10] The absence of a complete analysis of the total wealth of the executives is a limitation to the analysis of the motivations of executives to engage in swaps. In particular, the finding that firms permit the accounting gain to flow through the cash compensation contract is consistent with, but does not imply, the proposition that executives personally profit from the swap.

Since some firms include the swap gain as ordinary income and other firms report it as an extraordinary item, the effect of the swap gain on compensation depends, in part, on whether the firm's compensation plan is based on earnings before extraordinary items or after extraordinary items. While it is frequently difficult to determine whether a particular firm excludes extraordinary items in calculating its executive bonuses, summary data provided by consulting firms indicate that approximately 50 percent of firms with formal short-term bonus plans measure performance on the basis of earnings before extraordinary items, 40 percent base their bonuses on earnings after extraordinary items, and the choice of the earnings measure varies by organization level for the remaining ten percent of firms. Because both types of plans appear to be commonly used, we will estimate the relation between compensation and accounting earnings for all firms using income before extraordinary items and discontinued operations as the accounting measure of performance, and then repeat the analysis using net income (i.e., income after extraordinary items and discontinued operations).

Results of Estimating Equation (1)

Equation (1) is estimated in two steps.

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[8] In a related context, Murphy [1985] finds that the salary plus bonus component of executive compensation has a stronger statistical relationship with performance (as measured by stock price return and sales) than does total compensation.

[9] This argument would suggest that the sensitivity of our tests could be improved by further restricting our definition of compensation to the annual bonus (and excluding salary). Unfortunately, few firms separately disclose salaries and annual bonuses, especially over long periods of time. Since most firms disclose only the sum of salary and bonus, but not the individual components, we use salary plus bonus in our empirical analysis.

[10] Moreover, it is difficult to assign a value to "long-term" compensation whose ultimate payoff is contingent upon the realization of future performance measures. For example, Lambert et al. [1988] suggest that the value of an executive stock option to an executive will depend on his degree of risk aversion and his degree of diversification, and will generally be smaller than the Black-Scholes value.

First, the first-order autocorrelation coefficient is estimated from the residuals obtained from a regression of compensation on earnings in levels.[11] Second, the autocorrelation coefficient is used to transform the data as indicated in equation (1), and ordinary least squares procedures are used to estimate $\hat{a}_i$, $\hat{b}_i$, and the standard deviation of the regression residuals ($\hat{s}_i$). In each step, compensation and earnings data from 1970 to year $t-1$ are used in estimating equation (1), where year t denotes the swap year.[12]

Descriptive statistics associated with the estimation of equation (1) using earnings before extraordinary items and discontinued operations indicate that, on average, cash compensation has a statistically significant positive relation with earnings (Table 2, panel A). Moreover, the relation exhibits a substantial degree of explanatory power (e.g., the median adjusted R^2 is 0.350). Similar results are obtained using net income as the accounting measure of performance (Table 2, panel B). However, the explanatory power for the regressions is slightly smaller when extraordinary items and discontinued operations are included in the earnings number. These results provide some empirical confirmation that accounting performance measures, which are typically observed in funding formulas disclosed in proxy statements, have some relation with executive compensation. Interestingly, executive compensation has a much higher association with accounting earnings (R^2s of approximately 30 to 35 percent) than with security price returns (i.e., R^2s of approximately three to nine percent reported in Murphy [1986]).

Results in Table 2 also suggest that the intercepts and slope coefficients exhibit considerable differences across firms. While it is common for empirical studies in the executive compensation literature to estimate separate intercepts for each firm, many studies constrain the slope coefficient to be the same across firms (e.g., Abdel-khalik [1985; 1988], who regresses compensation on accounting earnings, and Murphy [1985] and Coughlan and Schmidt [1985], who regress compensation on firm size and stock price return). For our sample of firms, the hypothesis that the slope coefficients are the same for all firms can be rejected at the 0.01 level of significance both for the case in which accounting performance is measured using earnings before extraordinary items and discontinued operations and when accounting performance is measured using net income.

III. Analysis of Excess Compensation

Computation of Excess Compensation

Given the empirical model in equation (1), the unexpected portion of the manager's compensation for firm i in year t (or excess compensation) can be expressed as:

$$\Delta C_{i,t} = [(C_{i,t} - \hat{r}_i C_{i,t-1})] - [\hat{a}_i + \hat{b}_i(E^*_{i,t} - \hat{r}_i E_{i,t-1})] \quad (2)$$

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[11] The median first-order autocorrelation coefficient for the residuals of the regression estimated in levels using earnings before extraordinary items and discontinued operations was 0.177, with a range from −0.495 to 0.751. Twenty-five percent of the sample had an autocorrelation coefficient greater than 0.408. Similar values for the first-order autocorrelation coefficient were obtained when accounting performance was measured using earnings after extraordinary items and discontinued operations. Based on these results, we estimate the association between compensation and earnings using the autocorrelation adjustment. However, estimating equations (1) and (2) in levels, and conducting the associated tests on unexpected compensation with these estimates did not have a substantive effect on the empirical results.

[12] For firms that completed swap transactions in more than one year, the estimation period for the later swap transactions will include earnings numbers that have been affected by the earlier swap transactions. To avoid any problems that this might cause in estimating the parameters of the compensation function, we removed the effect of the earlier swap transactions from the earnings numbers from those periods.

TABLE 2

DESCRIPTIVE STATISTICS FROM THE FIRM-SPECIFIC REGRESSIONS OF CASH COMPENSATION ON EARNINGS[a]

Regression Model for Executive Compensation of Firm i:

$$(C_{it}-r_tC_{i,t-1})=a_i+b_i(E_{it}-r_tE_{i,t-1})+u_{it}$$

Panel A. With Earnings Measured Using Income Before *Extraordinary Items:*[b]

	$\hat{a}$	t-*statistic*$_a$	$\hat{b}$	t-*statistic*$_b$	R^2	*Adjusted* R^2
Mean	109.9	5.89	1.59	2.67	0.422	0.359
Median	97.5	5.04	1.13	2.48	0.415	0.350
TMean	102.3	5.38	1.45	2.55	0.418	0.355
StDev	93.5	5.22	2.27	3.08	0.263	0.291
Max	561.4	35.89	12.46	18.91	0.978	0.975
Min	−65.9	−2.26	−10.79	−9.43	0.000	−0.124
Q3	143.9	7.90	2.35	3.97	0.645	0.606
Q1	56.4	2.70	0.38	1.17	0.198	0.108

Panel B. With Earnings Measured Using Net Income:[b]

	$\hat{a}$	t-*statistic*$_a$	$\hat{b}$	t-*statistic*$_b$	R^2	*Adjusted* R^2
Mean	111.9	6.36	1.41	2.55	0.384	0.318
Median	101.3	5.41	0.91	2.30	0.383	0.319
TMean	108.3	5.89	1.20	2.36	0.376	0.309
StDev	74.2	5.19	1.80	3.08	0.267	0.296
Max	401.6	35.22	12.46	18.61	0.977	0.975
Min	−65.6	−2.26	−1.09	−9.52	0.000	−0.124
Q3	147.1	8.05	1.96	3.56	0.589	0.548
Q1	61.4	3.24	0.41	1.05	0.141	0.055

[a] In the regression estimation, compensation is expressed in thousands of (1967) dollars and earnings are expressed in millions of (1967) dollars. A separate regression was estimated for each of the 159 firms. The regressions were estimated using data from 1970 to the year prior to the swap.

[b] For notation, see Table 1.

where $E^*_{i,t}$ is the earnings number that *would have been reported in the absence of the swap.* For the regressions that measure accounting performance using income before extraordinary items and discontinued operations, we calculate $E^*_{i,t}$ by subtracting the swap gain from the reported earnings number for those firms that included the swap gain in ordinary income (i.e., $E^*_{i,t}=E_{i,t}-swap\ gain_i$). For the firms that reported the swap gain as an extraordinary item, the swap gain has already been excluded from $E_{i,t}$, so no adjustment to the reported earnings number is necessary. For the regressions in which accounting performance is measured using net income, we calculate $E^*_{i,t}$ by removing the swap gain from the reported income number for all firms (i.e., $E^*_{i,t}=E_{i,t}-swap\ gain_i$).

Equation (2) calculates the difference between the actual compensation received in the year of the swap and the level of compensation that would be expected given the compensation function estimated in equation (1) and the level of earnings that would have been reported in the absence of the swap transaction. This provides a direct means of assessing whether the accounting gain that arises due to the swap transaction is permitted to flow through the compensation function.[13,14] One critical assumption of this approach is that other managerial actions that have an effect on earnings would have remained the same had the swap not occurred. If these other actions are correlated with the swap decision, the computation of actual earnings minus the reported swap gain is, of course, not equal to the earnings number that would have been reported in the absence of the swap.[15]

One limitation to using equation (2) to calculate the excess compensation in the year of the swap is that it assumes that the contract is linear even if earnings in the year of the swap are extremely low. For example, if b_i is positive and $E^*_{i,t}$ is sufficiently negative, equation (1) would predict that compensation is negative. Since most CEOs have employment contracts that provide a positive lower bound to their compensation in a given year, a simple linear extrapolation of the compensation function estimated in equation (1) is likely to systematically underestimate the expected level of compensation and, thus, overestimate the level of excess compensation. In an attempt to address this problem, we modified equation (2) so that predicted compensation was at least equal to the estimated intercept from equation (1). This modification is used throughout the subsequent analysis.[16,17]

Benchmarks for Comparison

In order to test the null hypothesis that the swap gain is not allowed to flow through the compensation contract, we compare the measure of excess compensation, $\Delta C_{i,t}$, to four different (although related) benchmarks. In particular, two within-sample (compensation comparisons involving only the swap firms) and two between-sample (compensation comparisons involving the swap firms and

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[13] In contrast, studies by Simon [1983], Abdel-khalik [1985], and some of the tests conducted in Healy et al. [1987] focus on whether the parameters of the compensation contract are adjusted when the transaction of interest occurs. While the results of these tests can be used to test whether the form of the compensation contract has changed, it is often difficult to use the results of these tests to infer whether the change leads to an increase in compensation. For example, if the intercept of the contract increases, but the slope decreases (or vice versa), the executive's compensation could either increase or decrease relative to what it would have been in the absence of the change.

[14] Our analysis examines only the swap's effect on the *level* of compensation. However, the analysis is incapable of determining whether the swap has an effect on other parameters of the distribution of the CEO's compensation (e.g., the riskiness of compensation). In particular, a swap transaction typically has the effect of decreasing the firm's debt-to-equity ratio, which may result in a decrease in the variance of the firm's accounting earnings. If the riskiness of the executive's compensation also decreases, the swap may result in an increase in his utility even if he does not experience an increase in the level of compensation.

[15] As an example of this type of omitted variables problem, suppose a manager is contemplating a new capital investment program. In the early years of the program, the earnings of the firm may be adversely affected by the program, especially if the returns do not occur until subsequent time periods. The negative impact on short-term accounting earnings may have such a large effect on managerial compensation that the manager turns down the investment program. However, the manager may be willing to undertake the investment program if he or she is able to use the accounting gain produced by a swap transaction to, at least partially, offset the investment program's negative impact on short-term earnings. Under this scenario, the manager's decision to begin the investment program is related to the decision to complete the swap transaction. Therefore, the accounting gain due to the swap that is reported in the financial statements does *not* equal the total effect of the change on earnings. Moreover, it is precisely because the compensation scheme is not adjusted for "earnings manipulation" that the manager implements the capital investment program. The "gain" that the manager appears to receive from manipulating earnings merely compensates him for the short-term loss that he would have suffered from the investment program's effect on earnings. Ramanan [1985] provides related empirical evidence on the relation between capital investment and the decision to change from expensing interest to interest capitalization.

[16] We also calculated the results without this modification. Not surprisingly, the compensation comparison W_0 was significantly higher than the results reported here, but the overall interpretation of the results are very similar to the results reported in the text. The mean (median) ratio of the intercept to the average level of cash compensation for our sample of 159 firms is .561 (.536). This ratio is similar to the "typical" ratio of fixed salary to cash compensation reported in consulting firm surveys

a matching set of control firms) research designs are developed to attempt to control for various confounding influences on $\Delta C_{i,t}$. The four compensation comparisons are as follows (the superscript *e* refers to experimental firms and the superscript *c* refers to control firms):

$$W_0 = \Delta C^e_{i,t} - 0, \tag{3a}$$

$$W_{-1} = \Delta C^e_{i,t} - \Delta C^e_{i,t-1}, \tag{3b}$$

$$B_0 = \Delta C^e_{i,t} - \Delta C^c_{i,t}, \text{ and} \tag{3c}$$

$$B_{-1} = [\Delta C^e_{i,t} - \Delta C^c_{i,t}] - [\Delta C^e_{i,t-1} - \Delta C^c_{i,t-1}]. \tag{3d}$$

The first compensation comparison (denoted W_0) assumes that the regression model estimated using data from 1970 to $t-1$ is an appropriate characterization of the compensation model used by the firm in period t. Under these conditions, the expected value of $\Delta C^e_{i,t}$ is, by construction, equal to zero under the null hypothesis that the swap gain does not flow through the compensation function. This general approach is similar to standard event study procedures, and is well established in the accounting literature examining security market reactions.

The disadvantage of model W_0 is that it does not control for any other factors that systematically affect $\Delta C^e_{i,t}$. One example of a confounding factor is that the reporting requirements concerning the types of remuneration that are included in cash compensation are not constant over time. In particular, many companies included the payouts from long-term performance plans in the cash compensation figures over the period 1979 to 1982. It is typically very difficult to isolate the size of the performance plan payouts or even to determine whether the cash compensation figures contain performance plan payouts.

This reporting problem is likely to result in an overestimation of the excess compensation for firms whose swap occurred in 1981 or 1982, and an underestimation of the excess compensation for firms whose swap occurred in 1983 to 1984. To see this, suppose the "extra payouts" from performance plans are only included in the measure of cash compensation in years 1979 to 1982. Since the compensation model is estimated using the data from 1970 through the year prior to the swap, some of the data in the estimation period will contain the extra payments and some will not. Therefore, the estimated compensation model will *partially* incorporate the extra payments from performance plans. If a swap occurs in 1981 or 1982, the compensation in the event year will include the extra payment. Therefore, the excess compensation is likely to be positive in the year of the swap even without the swap gain. On the other hand, firms whose swap occurred in 1983 or 1984 have the extra payments in the estimation period, but not in the year of the swap. Therefore, these firms will tend to have a negative excess compensation, even without the swap gain.

The three remaining compensation

(e.g., Sibson & Co. [1986]) and provides some indirect support for the use of the estimated intercept as a lower bound for expected compensation.

[17] To further ensure that the results are not driven by the measure of expected compensation being biased in situations in which earnings is unusually low, we split the sample on the basis of the firm's standardized earnings forecast error in the year of the swap. The group with the most negative unexpected earnings had a median standardized forecast error of −1.39, so any bias in the compensation benchmark that might arise in years with low earnings would be greatest for these firms. In contrast, the median standardized forecast error for the subgroup with the highest standardized forecast error was 0.67. Since the median forecast error is positive for this subgroup, these firms should not be subject to the bias discussed above. We conducted the four compensation comparisons for these two groups of firms, and could not reject the hypothesis that the excess compensation is the same for both groups.

comparisons attempt to provide a greater degree of control for confounding events such as those described above. The second comparison (denoted W_{-1}) attempts to control for systematic misspecifications of equation (1) that are stable over time for a given firm. In this comparison, the excess compensation in the year of the swap is compared to the excess compensation in the year prior to the swap. If the confounding factor has an equal effect on both $\Delta C^e_{i,t}$ and $\Delta C^e_{i,t-1}$, the effect of this factor will be eliminated with model W_{-1}. For example, if long-term performance plan payouts are included in the compensation measure in both the year of the swap and the year prior to the swap, this confounding effect on compensation is less likely to be a problem with comparison W_{-1} than with comparison W_0.

The two remaining compensation comparisons utilize a control group of firms to provide the benchmark for $\Delta C^e_{i,t}$. These between-sample tests assume that a comparison sample can be constructed that will remove (or reduce) any industry-specific and time period effects on compensation that are unrelated to the swap transaction. Our control group is composed of firms in the *Forbes 500* that (1) did not engage in a swap, (2) have cash compensation data from 1970 to the year of the associated experimental firm's swap, and (3) have earnings data (both before and after extraordinary items and discontinued operations) on the annual or research COMPUSTAT files for the same period. A total of 398 firms in our compensation data base satisfied these three criteria.

From this group of potential control firms, each swap firm was matched with the control firm in the same two-digit SIC code whose market value of equity in the year prior to the swap was closest to that of the swap firm. Control firms were found for 154 of the 159 swap firms. The five firms without a control group were in SIC codes 21 and 41, which have relatively small numbers of firms. The swap firms were slightly larger than their corresponding control firms. Specifically, the mean difference in the market value of equity of the swap and control firms was \$393.26MM (matched-pairs $t=2.27$, $p<.05$, two-tail) and the median difference was \$37.38MM (Wilcoxon $Z=1.99$, $p<.05$, two-tail). However, the difference in firm size (especially the median difference) is small relative to the average size of the swap firms.

In the third compensation comparison (denoted B_0), the benchmark for the excess compensation of experimental firm i in the year of the swap is the excess compensation of its control firm in that year. This comparison assumes that both $\Delta C^e_{i,t}$ and $\Delta C^c_{i,t}$ are similarly affected by any systematic industry-specific or time period effects on compensation, so that their difference will reduce these effects. The disadvantage of this comparison (similar to the problem with model W_0) is that it does not consider the possibility that the regression models in equation (1) may be systematically misspecified over time for both swap and control firms.

The fourth compensation comparison (denoted as B_{-1}) is an attempt to provide a control for any systematic misspecification of the regression model in equations (1) and (2) within a firm over time *and* any industry-specific and time period effects on executive compensation. Similar to the between-sample analysis in B_0, our basic measure of interest is $[\Delta C^e_{i,t}-\Delta C^c_{i,t}]$. However, rather than comparing this difference to zero, we compare it to the corresponding difference computed in the year prior to the swap (i.e., $[\Delta C^e_{i,t-1}-\Delta C^c_{i,t-1}]$). This should control any misspecifications that are stable over time for the swap and control firms related to the regression analysis in equations (1) and (2).

To summarize, the excess compensation in the year of the swap is compared to four different benchmarks in order to assess whether the observed compensation is larger than would be expected if the accounting gain produced by the swap is not permitted to flow through the compensation function. Although somewhat conjectural, we believe that the above four comparisons are roughly ranked in terms of threats to internal validity. For example, comparison W_0 is perhaps the weakest research design and comparison B_{-1} the strongest. However, we are cognizant of the fact that each research design has unique advantages and disadvantages and, thus, we do not attempt to simply rely on one comparison. Our approach to interpreting the multiple comparisons is to assess whether the results tend to converge to an overall conclusion regarding whether executives implementing swaps earn additional compensation.

Statistical Tests

The primary statistical tests used in our analysis are the parametric one-sample or matched-pairs *t*-test (in which the measure of central tendency is the mean of the observations) and the nonparametric Mann-Whitney or Wilcoxon matched-pairs signed-rank test (in which the measure of central tendency is the median of the Walsh averages of the observations).[18] The null hypothesis is that the swap gain does not flow through the compensation contract, or that the central tendencies of the compensation comparisons W_0, W_{-1}, B_0, B_{-1} are equal to zero.

Swap Gain and Executive Compensation Results

Descriptive statistics and statistical tests for shifts in the central tendency of the four compensation comparisons are presented in Table 3. Panel A of Table 3 indicates that when the compensation function is estimated using earnings before extraordinary items and discontinued operations, the median excess compensation relative to the four compensation models ranges from \$5,050 to \$9,800 (in 1967 dollars). For comparison purposes, the median compensation from 1970 to year $t-1$ for the swap firms is \$188,600. Therefore, the magnitude of the excess compensation represents an increase in compensation of approximately four percent. While this may appear to be a small number, it is important to note that the size of this increase is comparable to the magnitude of the swap's effect on earnings reported in Table 1.

The results in Table 3 also indicate that the excess compensation relative to the four benchmarks is generally statistically insignificant at conventional levels. The one exception is comparison W_0.

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[18] We also conducted statistical tests using *standardized* measures of excess compensation. The standardization was achieved by dividing the excess compensation for firm *i* by the standard deviation of the residuals from the time period used to estimate the parameters of equation (1) and a confidence interval adjustment due to forecasting outside the estimation period [Patell, 1976]. The confidence interval adjustment is similar to that applied in security market event study analysis. This procedure for standardizing the prediction errors has the effect of placing a smaller weight on firms with unusual earnings in the year of the swap. As a result, this procedure will help to mitigate problems that arise if our compensation benchmark is systematically biased in situations in which earnings are unusually low. Although the statistical tests using standardized measures of excess compensation are likely to be better specified than the tests using unstandardized measures, we report only the unstandardized results for two reasons. First, the standardization procedure had little effect on the results of the tests for excess compensation. Second, the unstandardized measures of excess compensation are expressed in terms of dollars, whereas the standardized measures of compensation are dimensionless. Therefore, the unstandardized measures of compensation are more easily compared to the change in the value of the executive's stockholdings (which is also expressed in terms of dollars).

TABLE 3

DESCRIPTIVE STATISTICS FOR THE DIFFERENCE BETWEEN EXCESS COMPENSATION IN THE YEAR OF THE SWAP AND THE FOUR BENCHMARKS FOR EXCESS COMPENSATION[a]

Panel A. With Earnings Measured Using Income Before *Extraordinary Items:*

Compensation Comparison	n	*Mean*	*Median*	*TMean*	*StDev*	*Min*	*Max*	*Q1*	*Q3*	t-*stat*[b]	*Wilcoxon* Z[b]
W_0	159	8.32	9.80	10.45	64.64	−310.15	239.34	−18.62	44.71	1.62	2.58
W_{-1}	159	0.85	5.05	1.14	57.98	−193.76	266.23	−25.39	29.91	0.18	0.73
B_0	154	1.99	7.33	5.63	78.67	−354.29	193.27	−35.63	45.59	0.31	1.00
B_{-1}	154	6.05	6.79	5.89	85.79	−261.01	284.53	−43.14	49.93	0.87	1.04

Panel B. With Earnings Measured Using Net Income:

Compensation Comparison	n	*Mean*	*Median*	*TMean*	*StDev*	*Min*	*Max*	*Q1*	*Q3*	t-*stat*	*Wilcoxon* Z
W_0	159	12.10	8.43	11.37	54.54	−128.91	239.34	−16.73	43.46	2.80	2.72
W_{-1}	159	1.38	1.65	0.87	63.29	−200.26	266.23	−27.61	33.50	0.27	0.36
B_0	154	2.68	1.40	2.37	71.82	−217.24	207.83	−39.62	42.08	0.46	0.37
B_{-1}	154	3.93	7.42	1.38	84.45	−258.96	284.14	−47.41	38.18	0.58	0.34

[a] The four compensation comparisons utilize benchmarks for excess compensation that are defined in Section III. Compensation is expressed in thousands of (1967) dollars.

[b] Notation: *t*-stat is the *t*-statistic for a test that the mean of the excess compensation is equal to zero, and Wilcoxon *Z* is the *Z*-statistic for a test that the median of the excess compensation is equal to zero.

However, as discussed above, this compensation model is likely to have low internal validity because it does not control for systematic misspecification of the regression model in equation (1) over time for a specific firm and does not control for systematic industry-specific or time period effects on executive compensation.

The lack of statistical significance is consistent with the hypothesis that the swap gain has no effect on compensation or the hypothesis that the effect is, on average, too small to be detected by our tests. To provide some evidence on this issue, we repeated the analysis after partitioning the firms on the basis of the anticipated size of the effect on compensation. Our procedures for partitioning the firms are similar in spirit to, but more sophisticated than, the procedures used in earlier studies on the managerial incentives related to accounting transactions. Specifically, prior researchers have generally partitioned the firms on the basis of whether their proxy statement contains a description of an explicit accounting-based bonus plan. Since 151 (95 percent) of the firms in our sample report that they have a formal accounting-based bonus plan, this is not a very useful partitioning variable for our study.

The first procedure for partitioning the firms assumes that the effect of the swap gain on executive compensation depends on the estimated slope of the firm's compensation plan, the magnitude of the swap gain, and whether the swap gain is included in ordinary income or reported as an extraordinary item. For the case in which we estimate the form of the compensation plans using income *before* extraordinary items and discontinued operations as the accounting measure of performance, the swap gain should have no effect on compensation for firms that report the gain as an *extraordinary* income. On the other hand, if the swap gain is included in ordinary income, equation (1) predicts that, if the compensation plan is not adjusted for the accounting gain produced by the swap, the effect on executive compensation should be $b_i \times swap\ gain_i$.[19]

The second procedure for partitioning the firms is identical to the first, except that we use the terms of the compensation plan described in the firm's proxy statement to predict the magnitude that the firm's *bonus pool* would increase due to the swap gain. Although we argued in Section II that the information disclosed in proxy statements regarding the terms of the compensation plans is generally insufficient to allow us to develop a measure of the expected compensation of the CEO, some firms provided enough information to allow us to predict the magnitude of the increase in the bonus pool under the hypothesis that the bonus pool is not adjusted for the effect of the swap gain on earnings. We further assume that if the effect of the swap gain is predicted to be greater for the bonus pool of firm A than for firm B, the effect will also be greater on the compensation of the CEO of firm A than for firm B. The 67 firms that disclosed enough information in their proxy statements to calculate the potential size of the swap gain effect on their bonus pools were ranked on this basis, and the remaining firms were eliminated from this comparison.[20]

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[19] If the form of the compensation function was estimated using net income as the measure of accounting performance, the firm's decision to report the swap gain as ordinary income or as an extraordinary item is irrelevant to our determination of compensation. In this case, the effect of the swap gain on compensation equals $b_i \times swap\ gain_i$ for $firm_i$. The mean (median) value of $b_i \times swap\ gain_i$ was \$3,312 (\$1,678), which is slightly smaller than the compensation effects calculated in Table 3.

[20] For the 67 firms that disclosed sufficient information, the mean (median) increase in the size of the bonus pool was \$338,100 (\$15,000) in 1967 dollars under the hypothesis that the bonus formula is not adjusted for the swap gain.

TABLE 4

COMPARISON OF EXCESS COMPENSATION FOR SUBGROUPS OF FIRMS AFTER PARTITIONING FIRMS ON THE BASIS OF THE EXPECTED MAGNITUDE OF THE SWAP'S EFFECT ON EXECUTIVE COMPENSATION[a]

Panel A. Compensation Contract is Assumed to be Written in Terms of Income Before *Extraordinary Items:*

Variable Used to Construct Subgroups	*Low Subgroup*		*High Subgroup*		*Difference Between Subgroups*	
	Mean	*Median*[b]	*Mean*	*Median*[b]	t-*stat*[c]	*MW* z-*stat*[c]
Estimated Slope × Swap Gain						
Model W_0 ($n=159$)	−7.4	−0.9	23.8	26.0	3.11	2.88
Model W_{-1} ($n=159$)	2.8	6.5	−1.1	1.1	−0.42	−1.04
Model B_0 ($n=154$)	−16.7	−13.2	20.7	15.8	3.03	2.62
Model B_{-1} ($n=154$)	6.6	16.5	5.5	5.7	−0.08	−0.56
Δ Bonus Pool from Swap Gain						
Model W_0 ($n=67$)	0.1	3.7	22.2	26.4	1.47	1.77
Model W_{-1} ($n=67$)	−10.6	−1.5	20.0	11.3	1.96	1.83
Model B_0 ($n=64$)	−7.0	−6.1	15.7	19.2	1.12	1.52
Model B_{-1} ($n=64$)	−3.2	−2.8	28.0	18.9	1.22	1.35
Estimated Slope of Contract						
Model W_0 ($n=159$)	−5.0	−1.3	21.8	19.6	2.67	2.47
Model W_{-1} ($n=159$)	3.4	4.8	−1.7	6.5	−0.56	−0.19
Model B_0 ($n=154$)	−15.1	0.9	18.2	11.6	2.64	2.20
Model B_{-1} ($n=154$)	6.7	16.4	5.4	6.1	−0.10	−0.18
Slope From Funding Formula						
Model W_0 ($n=67$)	−2.1	8.6	30.4	30.7	2.07	2.07
Model W_{-1} ($n=67$)	−9.6	−5.1	25.4	20.9	2.13	2.67
Model B_0 ($n=64$)	−9.6	0.9	24.3	32.7	1.79	1.77
Model B_{-1} ($n=64$)	−5.0	−6.3	36.9	21.9	1.73	1.80
OVERALL MEAN OF COMPARISON STATISTICS					1.49	1.44

The final two variables used to partition the firms are based on the compensation scheme slope coefficient magnitude. Under the hypothesis that the compensation scheme is not adjusted for the swap gain, the swap's effect on executive compensation is, *ceteris paribus*, an increasing function of the magnitude of the compensation contract slope coefficient. The third partitioning variable uses the estimated slope from equation (1), and the fourth partitioning variable uses the slope of the bonus funding formula described in the firm's proxy statement (if sufficient information about the bonus formula is disclosed). Therefore, the first and third partitioning variables are based on empirical estimates of the form of the compensation plan, and the second and fourth partitioning variables are based on the bonus formulas described in proxy statements.

These four variables are used to separately partition the sample into a "HIGH" and a "LOW" subgroup on the basis of the magnitude of the swap gain's expected effect on compensation under the hypothesis that the compensation scheme is not adjusted for the accounting gain produced by the swap transaction. For each of the four partitioning variables, the four models of

TABLE 4—*Continued*

Panel B. Compensation Contract is Assumed to be Written in Terms of Net Income (Income After *Extraordinary Items):*

Variable Used to Construct Subgroups	*Low Subgroup*		*High Subgroup*		*Difference Between Subgroups*	
	Mean	*Median*[b]	*Mean*	*Median*[b]	*t-stat*[c]	*MW z-stat*[c]
Estimated Slope × Swap Gain						
Model W_0 ($n=159$)	1.6	−0.5	22.5	22.3	2.44	2.61
Model W_{-1} ($n=159$)	7.6	1.6	−4.7	1.6	−1.23	−0.36
Model B_0 ($n=154$)	−12.1	−11.7	17.1	13.5	2.55	2.51
Model B_{-1} ($n=154$)	4.1	10.4	3.7	3.6	−0.03	0.38
Δ Bonus Pool from Swap Gain						
Model W_0 ($n=67$)	0.5	3.3	20.4	26.9	1.30	1.55
Model W_{-1} ($n=67$)	−11.1	−1.4	−4.7	10.7	1.84	1.78
Model B_0 ($n=64$)	1.4	−0.2	17.1	12.0	0.33	0.55
Model B_{-1} ($n=64$)	−1.0	2.5	23.0	20.0	0.98	1.45
Estimated Slope of Contract						
Model W_0 ($n=159$)	5.4	−1.1	18.9	16.9	1.58	1.67
Model W_{-1} ($n=159$)	7.5	6.5	−4.8	−2.8	−1.23	−1.06
Model B_0 ($n=154$)	−7.5	−11.0	12.4	9.1	1.71	1.66
Model B_{-1} ($n=154$)	5.8	10.6	2.2	2.0	−0.27	−0.42
Slope From Funding Formula						
Model W_0 ($n=67$)	−3.6	−3.3	30.9	26.9	2.19	2.22
Model W_{-1} ($n=67$)	−9.7	−3.4	23.1	13.6	1.94	2.26
Model B_0 ($n=64$)	−5.4	−3.8	20.1	29.0	1.35	1.58
Model B_{-1} ($n=64$)	−5.4	5.2	34.9	15.9	1.69	1.56
OVERALL MEAN OF COMPARISON STATISTICS					1.07	1.25

[a] Compensation measures are expressed in thousands of (1967) dollars.

[b] Median of the Walsh Averages.

[c] *t*-stat is the *t*-statistic for a test of the equality of the means of the LOW and HIGH subgroups. MW *z*-stat is the Mann-Whitney *z*-statistic for a test of the equality of the medians for the LOW and HIGH subgroups. A positive value for these statistics indicates that the central tendency for the HIGH subgroup exceeded the central tendency for the LOW subgroup.

excess compensation given in equation (3) are used, resulting in a total of 16 comparisons. For each comparison, a parametric *t*-test and a nonparametric Mann-Whitney *z*-test are used to test the hypothesis that the excess compensation is equal for the two subgroups.

The results in Table 4 indicate that, relative to the compensation benchmarks, the excess compensation for the HIGH subgroup exceeds the excess compensation for the LOW subgroup in 12 of 16 of the comparisons. Taken individually, ten of the 16 Mann-Whitney *z*-statistics are significant at the 0.10 level (two-tail). The overall mean of the 16 Mann-Whitney z-statistics is 1.44. While it is difficult to calculate a precise measure of significance for this overall mean without knowing the correlation between the 16 comparisons, the overall mean is significant at the five percent level as long as the 16 correlated observations constitute the equivalent of at least two independent observations. The results using the parametric *t*-test, and the results in which accounting performance is measured using net income are similar.

The results are not completely consistent across the four partitioning variables and the four models for excess compensation. The results are most consistent when the firms are partitioned on the basis of the compensation contract parameters observed in proxy statements. Results of these comparisons yield a positive difference between the subgroups in every case. On the other hand, the results are not as consistent when the firms are partitioned on the basis of the estimated parameters of the compensation contracts. The results tend to be either positive and strongly significant (models W_0 and B_0) or negative and insignificant (models W_{-1} and B_{-1}).

Our overall interpretation of the results in Tables 3 and 4 is that the executives of firms completing a swap transaction experience an increase in compensation. The increase is largest (both in absolute magnitude and in statistical significance) for firms whose compensation plans and swap transactions would be expected to produce the greatest increase in compensation under the hypothesis that the accounting gain is allowed to flow through the compensation function. We interpret these results as being consistent with the hypothesis that firms do not adjust their salary plus bonus contracts for the accounting gain produced by the swap.

IV. ANALYSIS OF EXECUTIVE WEALTH

While the analysis in the previous section focused on the swap transactions' effect on the executives' salary plus bonus compensation, it is also of interest to examine the swaps' effect on other components of the executives' wealth. As established in prior research (see the references in fn. 2), the announcement of a swap transaction is associated with a stock price reaction that is, on average, negative. Therefore, it is tempting to conduct an event study to assess the change in the value of the executives' equity holdings, and then add this to the compensation comparisons calculated in Section III in order to compute the "total" effect of the swap transaction on the wealth of the executives. A problem with this approach is that it implicitly assumes that the security price reaction constitutes a measure of the desirability of the swap transaction from the perspective of shareholders. In particular, an adverse effect on shareholder wealth is assumed to be a sign that shareholders view a swap as a negative net present value transaction.

Prior research has generally been unable to determine any negative cash flow implications of swap transactions that would explain the magnitude of the security price response. In particular, the magnitude of the reaction is too large to be explained by the fee paid to the investment banking firm that participates in the swap transaction, the loss of the tax shield on the interest payments of the debt that is extinguished, or the "excess" compensation paid to managers as a result of the swap gain. Lys and Sivaramakrishnan [1987] suggest that the negative reaction may be due to the signalling aspects of the swap, rather than to the swap *per se*. That is, they suggest that managers take leverage-decreasing actions (such as swaps) when they acquire information that causes them to make downward revisions in their assessment of the firm's future earnings performance (see Ross [1977], Harris and Raviv [1985], and Miller and Rock [1985] for additional discussion). Lys and Sivaramakrishnan [1987] find that analysts revise their forecasts for annual earnings downward in the period surrounding the swap announcement, and the results in

Section II demonstrated that the earnings number that is reported at the end of the year is, on average, lower than time-series expectation models would predict. These results are consistent with the hypothesis that the market decreases the price of the firm's stock because it perceives the announcement of a swap as information that the firm's earnings prospects will be worse than expected.[21]

Although we cannot determine which of the above explanations for the security market reaction has descriptive validity, it is important to note that they have different implications regarding the method of computing the total impact of the swap on executive wealth. If the negative stock price reaction arises solely because the swap conveys information about the firm that would have been ultimately released (e.g., at the time of the next earnings announcement), then the swap, *per se*, has no adverse effect on either shareholder wealth or the value of the CEO's stock holdings (other than timing considerations). Under this scenario, it is not appropriate to add the decrease in the value of the CEO's stock holdings associated with the announcement of the swap to his excess compensation. Given the results in Tables 3 and 4, we would conclude that the executives do personally profit from swap transactions (especially the executives of firms with highly "accounting-oriented" compensation schemes).

In fact, the negative security market reaction could occur even if the swap, by itself, is a positive net present value transaction given the unfavorable private information possessed by the manager. The market reaction to the swap would then be composed of (1) the favorable effect of the swap itself and (2) the unfavorable effect of the information that the swap conveys about the firm's future earnings prospects. Assuming that the information about the firm's future earnings prospects would have ultimately been disclosed, the appropriate measure of the "total" effect of the swap on the executives' wealth would be the unexpected compensation calculated in Section III and the favorable effect of the swap *per se* discussed above (which we cannot measure). In this case, the excess compensation calculated in Section III provides a lower bound on the "total" effect of the swap transaction on executive wealth.

However, if the market reaction is the result of the swap transaction having a negative net present value, it is appropriate to add the change in the value of the CEO's stock holdings to the excess compensation computed in the previous section. In the following subsections, we discuss the method used to compute the change in the value of the CEO's stock holdings at the announcement of the swap, and the "total" effect of the swap on the executive's wealth.

Method

The changes in shareholder wealth associated with the swaps were analyzed by estimating the security market reaction in an event period centered on the day that the swaps were announced in *The Wall Street Journal*.[22] Daily returns and the daily value-weighted market index were obtained from the Center for Research on Security Price (CRSP) tape for an estimation period from day −120 to day −21 and an event period from day −20 to day +20. The single factor market model was assumed to be an adequate characterization of the return generating process, and this model was estimated via ordinary least squares in the estimation period. The daily excess returns, standardized excess returns, and squared standardized excess returns were estimated in the event period using the regression parameters, standard deviation of the market model residuals in the estimation period, and the confidence interval adjustment due to forecasting outside the estimation period (see Patell [1976] for a discussion of these statistics). The statistical significance of the average standardized excess returns and squared standardized excess returns was determined by using Normal theory tests and jackknifing methods.

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[21] To provide some insight into whether managers possess unfavorable private information at the time of the swap transaction, we examined the insider trading behavior of managers in the period surrounding the swap transaction. Specifically, we examined the dollars of insider buying minus the dollars of insider selling (for both open market and private transactions) in the six months prior to the swap relative to the same calendar period in the year prior to the swap. We could not reject the null hypothesis that the amount of insider trading was the same in these two time periods. These results suggest that either managers did not possess unfavorable private information at the time of the swap transaction, or they did not choose to use this information in making trading decisions.

[22] Alternatively, we could have used the date on which the preliminary registration statement concerning the

Results of Security Market Reaction to Swap Announcement

The average excess returns and associated statistical tests for the swap announcement were very similar to the results reported in prior research (see fn. 2). The security market reaction to the swap occurred in a short time interval prior to and including day zero.[23] The swap was, on average, associated with a *decrease* in shareholder wealth of approximately −1.01 percent over the time period from day −1 to day 0 ($p<0.05$, two-tail). The cumulative excess return from day −1 to day 0 corresponds to a mean decrease in shareholder wealth of $14.5MM, and a median decrease of $9.0MM.

The change in the value of the executive's equity holdings associated with the swap ($Stk\ Chg_i$) is computed by

$$Stk\ Chg_i = Shares_i \times Price_i \times CER_i,$$

where

$Shares_i$ = number of shares owned by the CEO of firm i in the year prior to the date of the swap,

$Price_i$ = price per share at the end of the fiscal year prior to the date of the swap, and

CER_i = cumulative excess return from day −1 to day 0 for firm i.

Expressed in 1967 dollars, the mean value of the CEO's equity ownership (i.e., $Shares_i \times Price_i$) for our sample was $1,268,645, and the median value was $271,800. When multiplied by the security market reaction to the announcement of the swap, the mean change in the value of the executives' stock holdings was −$17,825, and the median change was −$1,625. In addition, approximately 69 percent of the CEOs experienced a decrease in the value of their stock holdings over the period from day −1 to day 0.

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equity used in the swap was filed with the Securities and Exchange Commission. This filing date was available in the *Investment Dealer's Digest* for 85 of our firms. For this subsample, similar to the results in Hand [1987], the registration date precedes the *WSJ* date by a median distance of one trading day. Since the *WSJ* date is easily obtained and this date is very close to the date of the preliminary registration statement, the *WSJ* announcement for the swap is used as the event date.

[23] The sample size for the event study is only 157 because we could not find a *WSJ* announcement date or security price data was not available on the CRSP tape. There are several firms with multiple swap dates within a given fiscal year (e.g., 6/82 and 9/82). These two dates are treated as *separate* observations for the security market reaction computations. Since we use compensation changes in a given fiscal year as the unit of analysis, we sum the market response for the multiple swaps during a fiscal year in order to measure the total effect on executive wealth. After combining multiple swaps that occurred in the same fiscal year for a given firm, the total number of swap-years was equal to 139.

TABLE 5
ANALYSIS OF THE TOTAL EFFECT OF THE SWAP ON THE CEO'S WEALTH[a]

Panel A. With Earnings Measured Using Income Before *Extraordinary Items:*

	n	*Mean*	*Median*	*TMean*	*StDev*	*Min*	*Max*	*Q1*	*Q3*	*t-stat*[c]	*Wilcoxon Z*[c]
Total W_0[b]	139	−11.7	6.4	5.1	279.8	−2989.7	1130.6	−23.4	36.7	−0.49	1.16
Total W_{-1}	139	−17.4	0.8	−2.0	278.5	−3016.5	1079.1	−36.4	33.9	−0.74	−0.21
Total B_0	134	−19.7	4.6	−2.9	279.7	−2888.1	1140.3	−39.5	37.7	−0.82	−0.31
Total B_{-1}	134	−13.1	−1.2	0.2	281.0	−2897.1	1083.2	−45.5	47.2	−0.54	−0.07

Panel B. With Earnings Measured Using Net Income:

	n	*Mean*	*Median*	*TMean*	*StDev*	*Min*	*Max*	*Q1*	*Q3*	*t-stat*	*Wilcoxon Z*
Total W_0[b]	139	−7.2	2.3	5.9	276.8	−2982.6	1131.8	−22.1	36.5	−0.31	1.24
Total W_{-1}	139	−16.7	1.0	−2.2	279.8	−3012.9	1079.7	−42.8	34.4	−0.70	−0.22
Total B_0	134	−17.7	−0.2	−3.4	290.7	−3052.1	1141.5	−44.7	32.5	−0.70	−0.65
Total B_{-1}	134	−15.5	2.5	−3.0	289.5	−2998.6	1083.9	−56.6	42.8	−0.62	−0.43

[a] The Total effect on CEO wealth is expressed in thousands of (1967) dollars.

[b] The four measures of the total effect on CEO wealth are defined in equations (4a) to (4d).

[c] Notation: *t*-stat is the *t*-statistic for a test that the mean of the total effect on wealth is equal to zero and Wilcoxon *Z* is the *z*-statistic for a test that the median of the total effect on wealth is equal to zero.

Executive Wealth Effects of the Swap Transaction

Assuming that the security price reaction to the announcement of a swap provides a measure of the swap's desirability from the perspective of shareholders, we compute the "total" effect of the swap on the CEO's wealth by adding the excess compensation calculated in Section III to the change in the value of the CEO's equity holdings associated with the swap's announcement. As discussed in Section II, our executive compensation measure is salary plus annual bonus; therefore, our measure of the "total" wealth of the executives includes only (1) salary plus bonus and (2) the value of the shares owned in their firms.

Given the four benchmarks for excess compensation, the total effect of the swap can be expressed as:

$$\text{Total } W_0 = Stk\, Chg_i + \Delta C^e_{i,t} \tag{4a}$$

$$\text{Total } W_{-1} = Stk\, Chg_i + \Delta C^e_{i,t} - \Delta C^e_{i,t-1} \tag{4b}$$

$$\text{Total } B_0 = Stk\, Chg_i + \Delta C^e_{i,t} - \Delta C^c_{i,t} \tag{4c}$$

$$\text{Total } B_{-1} = Stk\, Chg_i + [\Delta C^e_{i,t} - \Delta C^c_{i,t}] - [\Delta C^e_{i,t-1} - \Delta C^c_{i,t-1}]. \tag{4d}$$

The null hypothesis is that the total effect on executive wealth is equal to zero.

Analysis of the total effect of the swap on executive wealth is presented in Table 5. The large differences between the mean, median, and trimmed mean indicate that several "outliers" are present in the data. For this reason, we will concentrate on the nonparametric results, which should be less influenced by the presence of these outliers. The results in Table 5 suggest that the total effect on executive wealth is relatively small and statistically insignificant.

The analysis of the swap's total effect was then repeated using the same procedure for partitioning the firms as in Table 4. Recall that the partitioning variables attempt to predict the anticipated size of the swap's effect on compensation under the hypothesis that the compensation scheme is not adjusted for the effect of the swap transaction on accounting income. The results of the comparisons of the total wealth effects for the subgroups are presented in Table 6. Overall, the results for the total wealth comparisons are similar to the excess compensation comparisons that are contained in Table 4, although not as statistically significant. The nonparametric results in Table 6 indicate that the total wealth effect for the HIGH subgroup exceeded the total wealth effect for the LOW subgroup in 14 of the 16 comparisons. Taken individually, six of the 16 Mann-Whitney z-statistics are significant at the 0.10 level (two-tail). The overall mean of the 16 Mann-Whitney z-statistics is 1.49. This overall mean is significant at the five percent level as long as the 16 correlated observations constitute the equivalent of at least two independent observations. The results for the case in which earnings was measured using net income are similar.

Similar to the results in Table 4, the total wealth comparisons were most consistent when the firms were partitioned on the basis of the compensation contracts parameters observed in proxy statements, and less consistent when the firms were partitioned on the basis of the estimated parameters of the compensation contracts. Although the tests that compare the total effect for the two subgroups are less conclusive than the tests for the compensation effect, our overall interpretation of these tests is that the executives of the firms in the "HIGH" subgroups experience a marginally greater increase in wealth than the executives of the firms in the "LOW" subgroups.

TABLE 6

COMPARISON OF TOTAL EFFECT OF THE SWAP ON THE CEO'S WEALTH FOR SUBGROUPS OF FIRMS AFTER PARTITIONING FIRMS ON THE BASIS OF THE EXPECTED MAGNITUDE OF THE SWAP'S EFFECT ON EXECUTIVE COMPENSATION

Panel A. Compensation Contract is Assumed to be Written in Terms of Income Before *Extraordinary Items:*

Variable Used to Construct Subgroups	*Low Subgroup*		*High Subgroup*		*Difference Between Subgroups*	
	Mean	*Median*	*Mean*	*Median*	*t-stat*[a]	*MW z-stat*[a]
Estimated Slope × Swap Gain						
Total W_0 ($n=139$)	1.0	−4.6	−25.0	19.7	−0.53	2.67
Total W_{-1} ($n=139$)	14.0	3.2	−51.0	−7.7	−1.35	−0.93
Total B_0 ($n=134$)	−9.0	−15.0	−32.0	10.1	−0.45	2.20
Total B_{-1} ($n=134$)	18.0	3.1	−47.0	−7.4	−1.29	−0.75
Δ Bonus Pool from Swap Gain						
Total W_0 ($n=62$)	−3.0	−1.6	11.2	21.0	0.95	1.32
Total W_{-1} ($n=62$)	−12.0	−4.5	7.6	7.4	1.26	1.23
Total B_0 ($n=59$)	−10.8	−14.0	5.3	18.4	0.81	1.23
Total B_{-1} ($n=59$)	−0.3	−10.5	14.0	1.4	0.54	0.56
Estimated Slope of Contract						
Total W_0 ($n=139$)	−42.0	−7.8	23.2	19.7	1.47	3.79
Total W_{-1} ($n=139$)	−33.0	−0.9	0.1	4.5	0.74	0.94
Total B_0 ($n=134$)	−57.0	−21.4	19.7	14.0	1.64	3.69
Total B_{-1} ($n=134$)	−35.0	−7.7	10.0	4.1	0.95	1.17
Slope From Funding Formula						
Total W_0 ($n=62$)	−5.3	5.4	18.0	19.3	1.59	1.50
Total W_{-1} ($n=62$)	−12.4	−13.7	12.9	19.7	1.62	2.22
Total B_0 ($n=59$)	−12.2	−1.4	11.1	29.1	1.32	1.32
Total B_{-1} ($n=59$)	−8.0	−15.1	28.0	9.5	1.52	1.71
OVERALL MEAN OF COMPARISON STATISTICS					0.67	1.49

V. SUMMARY

In this paper, we examine the relation between the increase in accounting earnings generated via an equity-for-debt swap and the change in executive compensation and wealth. Our results indicate that, on average, the accounting gain produced by a swap is associated with an increase in cash compensation (i.e., salary plus bonus) that is both small in magnitude and statistically insignificant. These results are similar to the executive compensation effects of accounting changes reported in Healy et al. [1987]. In that paper, the authors conclude that executives appear to earn slightly higher levels of compensation after an accounting change, but that the increase is not statistically significant when compared to a matched-pairs control group. The lack of statistical significance in our paper is consistent with the hypothesis that the swap gain has no effect on compensation or the hypothesis that the swap gain is, on average, too small to be detected by our tests.

To provide more detailed evidence on the relation between the swap gain and compensation, we partitioned the sample of firms into a HIGH and a LOW subgroup according to the magnitude of the

TABLE 6—*Continued*

Panel B. Compensation Contract is Assumed to be Written in Terms of Net Income (Income After *Extraordinary Items):*

Variable Used to Construct Subgroups	*Low Subgroup*		*High Subgroup*		*Difference Between Subgroups*	
	Mean	*Median*	*Mean*	*Median*	*t-stat*[a]	*MW z-stat*[a]
Estimated Slope × Swap Gain						
Total W_0 (n=139)	13.0	−5.0	−26.0	16.3	−0.84	1.98
Total W_{-1} (n=139)	22.0	1.3	−54.0	−7.3	−1.64	−1.14
Total B_0 (n=134)	0.0	−12.4	−34.0	5.6	−0.69	1.81
Total B_{-1} (n=134)	18.0	9.7	−47.0	−7.7	−1.33	0.64
Δ Bonus Pool from Swap Gain						
Total W_0 (n=62)	−3.1	1.2	9.6	19.0	0.83	1.02
Total W_{-1} (n=62)	−11.8	−1.0	6.8	10.7	1.14	1.36
Total B_0 (n=59)	−1.3	−7.6	−1.9	9.0	−0.03	0.39
Total B_{-1} (n=59)	0.8	7.2	10.0	10.3	0.36	0.77
Estimated Slope of Contract						
Total W_0 (n=139)	−29.0	−5.0	17.3	16.9	1.04	2.35
Total W_{-1} (n=139)	−27.0	0.8	−5.0	1.1	0.49	−0.13
Total B_0 (n=134)	−46.0	−13.5	11.2	8.7	1.15	2.51
Total B_{-1} (n=134)	−33.0	3.1	2.5	2.5	0.72	0.30
Slope From Funding Formula						
Total W_0 (n=62)	−6.9	−5.4	18.4	19.0	1.71	1.64
Total W_{-1} (n=62)	−12.0	−11.1	11.6	15.0	1.46	1.86
Total B_0 (n=59)	−7.3	−9.2	7.4	9.0	0.80	1.01
Total B_{-1} (n=59)	−7.1	−0.1	24.3	7.4	1.32	1.15
OVERALL MEAN OF COMPARISON STATISTICS					0.41	1.10

[a] *t*-stat is the *t*-statistic for a test of the equality of the means of the LOW and HIGH subgroups. MW *z*-stat is the Mann-Whitney *z*-statistic for a test of the equality of the medians for the LOW and HIGH subgroups. A positive value for these statistics indicates that the central tendency for the HIGH subgroup exceeded the central tendency for the LOW subgroup.

predicted effect of the swap gain on executive compensation under the hypothesis that the accounting gain produced by the swap is allowed to "flow through" the compensation function. This approach provides a more sophisticated means of assessing whether a firm's compensation scheme is highly accounting-oriented than the typical procedure used in the accounting literature, which is to partition firms on the basis of whether their proxy statement contains a description of an explicit accounting-based bonus plan. Our results indicate that the excess compensation for the HIGH subgroup exceeded the excess compensation for the LOW subgroup. We interpret these results as being consistent with the hypothesis that firms do *not*, on average, adjust their annual bonus plans for the effect of the swap gain on accounting earnings.

One interpretation of the finding that firms do not use their annual bonus plans to penalize managers for engaging in swap transactions is that shareholders do not perceive these transactions *per se* to adversely affect their wealth. Under this scenario, the negative stock price reaction associated with the announcement of swaps might be interpreted as arising because swaps convey bad news about the firms' future earnings prospects, and not because swaps themselves are negative net present value projects.

Alternatively, if the adverse market reaction to the announcement of the swap is the result of the swap being a negative net present value transaction from the perspective of shareholders, our evidence suggests that there is an unresolved conflict of interest between managers and shareholders with respect to swap transactions. That is, we find that managers experience an increase in their cash compensation despite the adverse effect on shareholder wealth. While the magnitude of the compensation increase is not especially large, the percentage increase in compensation is comparable in magnitude to the percentage increase in earnings produced by the swap.

The absence of a complete examination of all of the components of executive wealth is, of course, a limitation to this interpretation of our results. In particular, we cannot be certain that executives are not penalized via other components of their compensation. For example, we find that the top executives experience a decrease in the value of their equity holdings in their firms that is, on average, comparable in size to the increase in their compensation. However, there is some weak evidence that the total effect of the swap transaction on executive wealth is positive for firms whose compensation plans are more "accounting-oriented" (i.e., the increase in compensation exceeds the decrease in the value of personal equity holdings).

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Measuring Security Price Performance in Size-Clustered Samples

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ABSTRACT: This study assesses the impact of the firm size effect on test statistics based on market-adjusted and market model abnormal returns. The performance of two alternative abnormal return methods that explicitly control for the effect of firm size on expected returns is also examined. These methods, the size control portfolio and size model approaches, are based upon a companion portfolio approach where companion portfolios are constructed on the basis of firm size. Simulation results indicate that when event dates are clustered in calendar time and the event affects either small or large firms, conventional *t*-statistics based on market-adjusted or market model abnormal returns are misspecified in that their empirical Type I error rates deviate significantly from those expected under a true null hypothesis. Significance tests based on empirical distributions mitigate these over-rejection tendencies but, in doing so, they sacrifice power. On the other hand, conventional *t*-statistics based on size control portfolio or size model abnormal returns are well-specified across a variety of event conditions. Accordingly, either size-based method can control for the firm size effect in event study contexts where such control is warranted. Since the size control portfolio approach is simpler to implement, it is the preferred alternative. The study also documents that abnormal performance is detected more often when large firms are affected than when small firms are affected.

THIS paper extends the analysis in Foster et al. [1984] on how the widely documented firm size effect (as examples, see Banz [1981], Reinganum [1981], and Keim [1983]) confounds empirical analyses employing market-adjusted and/or market model abnormal returns. We also analyze two methods of estimating abnormal returns that explicitly control for the firm size effect. The alternative methods rely on companion portfolios formed on the basis of firm size. These alternative methods are referred to below as: (1) size control portfolio abnormal returns and (2) size model abnormal returns. The first measure is simply each firm's return, R_{it}, minus the return on an equally-weighted portfolio of firms of similar market value, R_{pt}. The second measure is identical to the traditional market model except that R_{pt} replaces R_{mt}, where R_{mt} is the return on the market portfolio.

The previous research by Foster et al. [1984] on the pre- and post-earnings an-

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nouncement behavior of security returns documents the importance of controlling for the firm size effect. They demonstrate [pp. 599–602], that when firms are organized into size quintiles, empirical tests using market-adjusted returns result in earnings association effects being confounded by the firm size effect. The authors control for the firm size effect by using size control portfolio abnormal returns and significance tests based on empirical distributions.

Our analysis extends the results of Foster et al. along several dimensions. First, we evaluate and compare four alternative abnormal return measures. This allows identification of circumstances for which alternative abnormal return measures control or fail to control for the firm size effect. Stated differently, we identify instances where a simple method is appropriate, as well as instances where a more complex method is warranted. Second, we provide detailed comparisons of the properties of significance tests based on empirical distributions with those based upon conventional *t*-tests. This involves comparing the Type I error rates and power of these two significance tests across a variety of event conditions.[1] Detailed comparison of significance tests based on empirical distributions *vis-á-vis* conventional *t*-tests allows: (1) identification of circumstances where researchers can benefit by selecting one over the other, and (2) documentation of the magnitude of the differences in Type I errors under various circumstances. Finally, our analysis is performed via simulations (i.e., by repeatedly seeding abnormal performance) and not in the context of one particular event study.

Our results have implications for designing future event studies in that size-based abnormal return measures provide an approach to detecting the impact of events on security returns in settings where control for the size effect is needed. In addition to earnings announcement studies similar to Foster et al. [1984], examples of such settings include studies of the economic consequences of accounting regulatory decisions by the FASB and/or the SEC. It is not uncommon to encounter circumstances where a policy announcement's effect is restricted to firms of a given size. For example, primarily large firms were affected by foreign currency translation requirements (SFAS No. 8 and SFAS No. 52), inflation accounting disclosures (SFAS No. 33), and accounting for pensions (SFAS No. 87); and small firms by accounting for research and development costs (SFAS No. 2) and oil and gas accounting (SFAS No. 19). Furthermore, some studies conduct cross-sectional regressions with abnormal returns as the dependent variable to test various hypotheses that relate firm characteristics to the magnitude of their market reactions to policy announcements. In such contexts, failure to control for the effect of firm size on abnormal returns could confound the results (e.g., tests of the political cost hypothesis, assuming firm size is used as a proxy for political costs), or induce spurious correlation.

The remainder of the paper is organized as follows. Section I reviews the relevant literature. Section II outlines the experimental design. Section III contains our simulation results. Finally, Section IV provides a summary and our conclusions.

I. RELATED RESEARCH

The pervasiveness of event studies in capital market research has led researchers to investigate alternative measures of abnormal performance in daily data (e.g., Brown and Warner [1985] and Dyckman et al. [1984]). In general, these studies conclude that in most instances test statistics based on market model abnormal returns are both well-specified and reasonably powerful in detecting abnormal performance, and in some instances even simpler methods suffice.[2] Researchers have come to rely upon the results of these studies to justify their choice of an abnormal return measure. A potential problem in extending the results of these studies is that researchers are extending the results of repeatedly selected random samples to settings where samples are not randomly selected (i.e., in the typical event study firms are not randomly selected).

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[1] While Foster et al. base significance tests on empirical distributions, they do not make Type I error or power comparisons with alternative significance tests.

Reliance on the results in Brown and Warner and Dyckman et al. would not be problematic if there were no systematic behavior in non-event period abnormal returns. However, given the evidence on the relation between firm size and abnormal returns, failure to account for the firm size effect in an event study context may lead to Type I error rates that deviate from their nominal levels. Schwert [1983] concludes that when a sample is comprised of firms of a given size, researchers should take the firm size effect into account when estimating conditional expected returns. Dimson and Marsh [1986] and Foster et al. [1984] report that failure to control for the firm size effect can lead to biased inferences in an event study context. While these studies provide important insights into the problems associated with ignoring the firm size effect, they represent only two observations in the population of event studies. Accordingly, we examine the implications of the firm size effect for the design of event studies by examining the performance of alternative methods in a large number of cases via simulations.

II. EXPERIMENTAL DESIGN

Data Requirements

The following data availability criteria had to be met for a firm to be included in our simulation. A firm was eligible for selection on a randomly selected event date if it had year-end market value data on the CRSP Monthly Returns file or the COMPUSTAT Annual Industrial file for any year during 1963–1981. This requirement was imposed so that firms could be assigned to market value portfolios at common and uniform points in time to estimate market and size model parameters and corresponding abnormal returns. Firms meeting this criterion were then required to have two consecutive years of daily return data available from CRSP for any two-year period from 1963–1982.[3] Returns from the first year of this two-year window were used to estimate market and size model parameters so that abnormal returns could be estimated for each trading day in the following year (estimation techniques are discussed in detail below).

Abnormal Return Measures

The simulation results reported below are based on the following four abnormal return measures.

1. *Market-Adjusted Abnormal Return.* Letting R_{it}=the return on firm i on day t, and R_{mt}=the return on the CRSP Equally-Weighted Market Index on day t, the market-adjusted abnormal return on security i on day t is:

$$u_{it}=R_{it}-R_{mt}. \qquad (1)$$

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[2] The term well-specified means Type I error rates are within a 95 percent confidence interval for the nominal significance level of the test.

[3] These requirements restrict our sample to NYSE and AMEX firms.

2. *Market Model Abnormal Return.* The market model abnormal return on security i on day t is:

$$u_{it}^{m}=R_{it}-(\hat{a}_i+\hat{b}_iR_{mt}), \quad (2)$$

where $\hat{a}_i$ and $\hat{b}_i$ are OLS estimates of the market model parameters α_i and β_i, and R_{it} and R_{mt} were defined above.[4]

3. *Size Control Portfolio Abnormal Return.* Letting R_{pt}=the equally-weighted return on the market value portfolio of which firm i is a member, the size control portfolio abnormal return on security i on day t is:

$$u_{it}^{s1}=R_{it}-R_{pt}. \quad (3)$$

Market value portfolios are constructed at the end of every year from 1963–1981 by ranking firms on their year-end market value of equity and dividing them into ten portfolios, each containing an equal number of firms. We then calculate R_{pt} for each trading day of the following year (i.e., 1964–1982) as:

$$R_{pt}=\frac{1}{N_p}\sum_{i=1}^{N_p}R_{it}, \quad (4)$$

where N_p is the number of firms in market value portfolio p ($p=1,2,\ldots,10$). N_p is the same for each market value portfolio in a given year, but varies over time.[5]

4. *Size Model Abnormal Return.* The size model abnormal return on security i on day t is:

$$u_{it}^{s2}=R_{it}-(\hat{a}_i^s+\hat{b}_i^sR_{pt}), \quad (5)$$

where $\hat{a}_i^s$ and $\hat{b}_i^s$ are OLS estimates of the size model parameters α_i^s and β_i^s.

The strict control portfolio approach of equation (3) is a special case of the size model method in equation (5) where $\alpha_i^s=0$ and $\beta_i^s=1$. Moreover, equation (3) allows for differences in relative risk across market value portfolios, but assumes that within market value portfolios firms have the same relative risk. On the other hand, equation (5) allows relative risk to vary across market value portfolios and a restricted measure of risk to vary within market value portfolios. The motivation for examining both of these methods is to document whether it is or is not advantageous to allow the restricted measure of relative risk to differ across firms.[6]

The motivation for examining the above four abnormal performance measures is: (1) to facilitate the study's linkage with related research, and (2) to provide guidance to researchers in event study contexts where control for the firm size effect is warranted.

Our approach to estimating model parameters differs from that in Brown and Warner and Dyckman et al. They first generate an event date and then estimate market model parameters over a time period immediately preceding the date selected. We first construct separate time-series of market model and size model abnormal returns for each firm in our sample. The motivation for this approach stems from our need to construct market value portfolios at common and uniform points in time for the purpose of estimating size model parameters (an issue not faced in the other studies).

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[4] Since both Brown and Warner and Dyckman et al. conclude that alternative systematic risk estimation techniques (e.g., see Scholes and Williams [1977] and Dimson [1979]) yield little increase in the power of the test to detect abnormal performance, we rely upon their results and estimate market and size model parameters using OLS.

[5] The R_{pt} series for the ten market value portfolios on every trading day over the 1963–1982 time period are available upon request. CRSP provides R_{pt} on a monthly, rather than a daily, basis.

[6] *Ex ante*, the gains from using the abnormal returns from equation (5) in place of the size control portfolio returns from equation (3) are not obvious. This is because the average size model alpha and beta of each market value portfolio are 0 and 1 by construction. Thus, over a large number of samples, working with equation (5) may yield similar results to those of equation (3).

Specifically, we use a two-year moving window (19 in total, i.e., 1963–1964, 1964–1965,...,1981–1982) to first estimate market and size model parameters, and then to generate abnormal returns. The daily returns in the first year of the window are used to estimate model parameters. These parameters are then used to generate size and market model abnormal returns for each trading day of year two.

The above procedure yields two distinct time-series of abnormal returns for each firm that met data availability requirements for any two-year period during 1963–1982. One is made up of market model abnormal returns while the other is made up of size model abnormal returns. Both time-series begin with the first trading day in 1964 and end with the last trading day in 1982. In addition, time-series of market-adjusted abnormal returns and size control portfolio abnormal returns are generated for the same time period and the same firms using equations (1) and (3). Using these four time-series of abnormal returns we randomly generate event dates, select securities, and simulate the particular event condition under study. We do not require firms to be listed continuously on CRSP or COMPUSTAT over the entire 1963–1982 period, a requirement that would induce a survivorship bias. Firms enter or leave our data base due to listings, delistings, mergers, lack of year-end market value data, or insufficient data to estimate model parameters. The number of firms in our four time-series is the same in a given year, and ranges from 1,500 in 1964 to 2,300 in 1982.

Table 1 reports descriptive statistics for daily returns, market value of equity, and market and size model adjusted R^2s for the ten market value portfolios. The average daily returns range from .147% for the smallest market value portfolio to .032% for the largest market value portfolio. Consistent with previous research (e.g., see Foster et al. [1984, p. 586]), average returns decline monotonically as firm size increases. The average market value of the portfolios reveals a substantial dispersion in the size of firms included in the sample. Turning to the explanatory power of the market and size models, the adjusted R^2s from the OLS regressions are quite modest and increase monotonically with firm size. A comparison of adjusted R^2s reveals that the size model's improvement over the market model occurs primarily in portfolios 1 and 10. The relative percentage increases in adjusted R^2 are 20.8% and 26.0%. However, for portfolio 1 the absolute improvement is only 1.0%. For the remaining portfolios, the improvement is modest and negative in one case.

Event Conditions

The four methods of measuring abnormal return discussed above are examined under the following combinations of event conditions:

1. The magnitude of induced abnormal performance, 0%, .1%, .5%, 1%, 2%, and 3%.
2. The sign of the induced abnormal performance, positive or negative.
3. Sample composition, small firms or large firms.
4. Clustering versus non-clustering of event dates.
5. Event date occurrence, random selection of dates from all calendar months, or randomly selected, but constrained to occur in January.

Motivation for these event conditions is summarized below. The range of the seeded abnormal return from 0% to 3% corresponds to those used in Brown and Warner [1985] and Dyckman et al. [1984]. Since research documenting the

Table 1

Descriptive Statistics for Market Value Portfolio Raw Returns Market Values, and Size and Market Model R^2s

Size Portfolio[a]	Mean Daily Raw Return in Percent[b]	Standard Deviation of Raw Return in Percent	Mean Market Value[c]	Mean Market Model Adjusted R^2[d]	Mean Size Model Adjusted R^2	Improvement in Adjusted R^2 in Percent[e]
Smallest	.147	.931	5.1	4.8	5.8	20.8
2	.096	.905	13.2	7.1	7.7	8.5
3	.080	.899	24.3	9.3	9.9	6.5
4	.067	.885	39.6	10.7	10.5	−1.9
5	.064	.858	63.1	12.0	12.6	5.0
6	.061	.823	103.7	12.3	13.0	5.7
7	.051	.797	170.1	12.9	13.7	6.2
8	.049	.792	303.8	13.8	15.0	8.7
9	.042	.769	597.1	14.6	16.6	13.7
Largest	.032	.788	2808.8	17.3	21.8	26.0
Full Sample	.069	.847	412.9	11.5	12.7	10.4

[a] Market value portfolios are constructed every year from 1963–1981 by ranking all available NYSE-AMEX securities on the basis of year-end market value of equity.

[b] Equally-weighted average daily raw return on the market value portfolio over the 1964–1982 period.

[c] Grand mean of the market value of equity of all firms in the market value portfolio over the 1964-1982 period (millions of dollars).

[d] Grand mean of the adjusted R^2s of the firm-by-firm market and size model regressions of all firms in the respective market value portfolio in any year from 1964–1982. The mean value is based on approximately 3,000 observations per market value portfolio.

[e] Using the portfolio averages, this is calculated as (Size Model R^2 − Market Model R^2)/Market Model R^2.

firm size effect has shown that the distribution of abnormal returns of small and large firms have different properties (e.g., Reinganum [1981, p. 40] and Keim [1983, p. 26]), an important part of our research lies in examining the specification of tests of positive as well as negative abnormal performance. Since Keim [1983] reports the 50% of the firm size effect occurs in January, we simulate January-only event dates to provide a severe test of the ability of the size control portfolio and size model methods to control for the firm size effect.[7] The large (small) firm classification requires firms to be drawn from the top (bottom) two market value portfolios.[8] Finally, throughout the analysis we assume that the event date is known with certainty.[9]

The four measures of abnormal return are compared by reporting the percentage of 250 samples of 50 securities each where the null hypothesis of zero abnormal price performance is rejected at the .05 level. Recall that our simulations are conducted by sampling from the four time-series of firm-specific market-adjusted, market model, size control portfolio, and size model abnormal returns discussed above. We artificially introduce abnormal performance into these data by simply adding a particular level of abnormal performance to each selected firm's abnormal return.

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[7] Regardless of whether the event is restricted to occur in January or is drawn from all calendar months, market and size model parameters are estimated using data from all calendar months.

[8] We also performed simulations using samples comprised of all firms regardless of size. Since these results are not central to our study, they are not reported in the paper. They are available upon request.

[9] When event dates are not clustered in calendar time a hypothetical event date is generated for each randomly selected security. However, the program that runs our simulations requires the event dates to occur in the same calendar year. The event date generated for the first randomly selected security determines the calendar year for the remaining 49 securities in the sample. When event dates are clustered in calendar time one event date is generated for all randomly selected securities. We also performed simulations reflecting event date uncertainty. Consistent with Brown and Warner and Dyckman et al., the results indicate that the power of the test declines considerably with lack of precise knowledge of the event date.

Significance Tests

For each of the 250 randomly selected samples, statistical significance of the sample mean abnormal return is assessed in two ways. One is a conventional *t*-test, while the other is an empirical distribution test.[10] Their features are discussed in turn.

The *t*-statistic is defined as the equally-weighted portfolio abnormal return on the event day divided by an estimate of its standard error. It assumes cross-sectional independence in the abnormal returns.[11] More formally,

$$\bar{u}_t/[s(u_t)/\sqrt{N}] \sim t_{N-1}, \qquad (6)$$

where

$$\bar{u}_t = \frac{1}{N}\sum_{i=1}^{N} u_{it},$$

and

$$s(u_t) = \sqrt{\sum_{i=1}^{N}(u_{it}-\bar{u}_t)^2/(N-1)},$$

where u_{it} is the abnormal return from one of the four examined return metrics as defined in equations (1), (2), (3), and (5), $\bar{u}_t$ is the mean abnormal return on day t, $s(u_t)$ is an estimate of the standard error of u_t, and N is the number of securities in the sample (i.e., 50).

The estimated standard error of the sample mean abnormal return is a cross-sectional estimate based upon event date abnormal returns. We use the simple *t*-test in equation (6) in part to see how well the independence assumption works when samples are clustered only on the basis of firm size. A second reason for using the simple *t*-test is to ascertain whether it is well-specified when the size control portfolio and size model abnormal return methods are used. Finally, because we also conduct significance tests based on empirical distributions of abnormal returns, use of a simple *t*-test provides a basis for comparing the specification of a significance test which makes fairly restrictive assumptions about the cross-sectional properties of abnormal returns (i.e., the simple *t*-test) with one not making such assumptions (i.e., an empirical distribution test).[12]

Brown and Warner examine the implications of alternative variance estimation procedures and conclude that methods that assume cross-sectional independence can be more powerful than approaches that assume cross-sectional dependence. This finding obtained for industry diversified samples when event dates were clustered in calendar time and it may not obtain if the sample firms belong to similar industries (e.g., Bernard [1987]). For the reasons stated above and because our simulated samples are unlikely to be industry clustered, we adopted the independence assumption embodied in the simple t-test. In Section III we assess the sensitivity of the simulation results based on t-tests to the existence of cross-sectional dependence in the abnormal return data.

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[10] We are grateful to the referee for recommending significance tests based on an empirical distribution of abnormal returns.

[11] Standardizing the abnormal returns, while increasing the comparability of the rejection frequencies across size portfolios, is unlikely to alter the rejection frequencies since we examined the abnormal return variances of individual securities and found them to be homoscedastic *within* market value portfolios.

[12] We hasten to note that in certain event study contexts (e.g., industry and calendar-time clustering), *ex ante*, the simple *t*-test appearing in equation (6) would clearly be inappropriate and should not be relied upon (e.g., see Collins and Dent [1984]).

An alternative way to assess the statistical significance of the sample mean abnormal return is to use a significance test based on an empirical distribution of the particular abnormal return measure. Marais [1984] and Foster et al. [1984] use such an approach. Significance tests based on empirical distributions do not require distributional assumptions (e.g., normality), and they take into account cross-sectional dependencies and variance differences. Accordingly, we also assess significance by comparison to the 5th (when the alternative hypothesis is negative mean abnormal performance) or the 95th percentile (when the alternative hypothesis is positive mean abnormal performance) of an empirical distribution constructed from the particular abnormal return measure under consideration. Since we document, for the most part, that significance tests based on conventional t-statistics are well-specified when event dates are not clustered in calendar time, we restrict our use of empirical distribution tests to clustered event dates.

Empirical distributions are separately generated for both large and small firm classifications based on each of the four abnormal performance measures as follows:[13]

1. Select a year without replacement from the 1964–1982 period (19 years in total).
2. Randomly select a sample of 50 firms from the large (small) firm classification and compute the average abnormal return on this sample for every trading day during the year (yielding approximately 250 average daily abnormal returns).
3. Repeat (2) a total of 5 times (yielding approximately 1,250 average daily abnormal returns).
4. Repeat (1)–(3) a total of 19 times (yielding approximately 1,250 × 19 = 23,750 average daily abnormal returns).[14]

III. SIMULATION RESULTS

This section reports simulation results and is organized into the following subsections: (1) event dates not clustered in calendar time, (2) event dates clustered in calendar time with significance tests based on conventional t-tests, (3) event dates clustered in calendar time with significance tests based on empirical distributions, (4) event dates clustered in calendar time, but constrained to occur in January, with significance tests based on conventional t-tests, (5) event dates clustered in calendar time, but constrained to occur in January, with significance tests based on empirical distributions, and (6) pairwise cross-correlations among the various abnormal return measures.

Non-Clustered Event Dates

Table 2 contains simulation results comparing the four abnormal return measures when event dates are not clustered in calendar time. The values in panel A (B) of Table 2 correspond to the percentage of 250 samples where a conventional t-test rejects the null hypothesis at the 5% significance level in large (small) firm samples. Using the binomial distribution, the 95% confidence interval for

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[13] Detailed properties of these eight empirical distributions, as well as those constructed from all other market value classifications are available upon request.

[14] The actual number is 23,845 because some years have more (less) than 250 trading days.

TABLE 2
A COMPARISON OF ALTERNATIVE ABNORMAL RETURN MEASURES WHEN EVENT DATES ARE NOT CLUSTERED IN CALENDAR TIME: NO RESTRICTION ON EVENT DATES[a]
($n=250$ SAMPLES)

Panel A. Large Firms:[b]—Significance of Event Date (Day 0) Abnormal Performance Based on a One-Tailed t-test $\alpha=.05$:[c]

Abnormal Return Measure[d]	*Rejection Rates (in percent) for Induced Abnormal Performance of:* 0	.1	.5	1	2	3
Market-Adjusted	10.5	20.6	74.1	98.8	100	100
Abnormal Return	4.9	9.7	54.3	94.7	100	100
Market Model	4.5	9.7	68.0	98.0	100	100
Abnormal Return[d]	4.0	21.1	73.7	98.0	100	100
Size Control	5.7	13.8	72.1	99.6	100	100
Portfolio	4.5	12.1	69.6	98.4	100	100
Abnormal Return						
Size Model	6.1	13.4	72.9	98.4	100	100
Abnormal Return[d]	4.0	10.9	67.7	99.2	100	100

Panel B. Small Firms[b]—Significance of Event Date (Day 0) Abnormal Performance Based on a One-Tailed t-test $\alpha=.05$:[c]

Abnormal Return Measure[d]	*Rejection Rates (in percent) for Induced Abnormal Performance of:* 0	.1	.5	1	2	3
Market-Adjusted	8.5	11.3	34.0	66.4	96.8	100
Abnormal Return	5.3	6.5	23.9	53.4	92.3	100
Market Model	4.9	8.9	27.9	60.7	97.6	99.1
Abnormal Return[d]	5.3	8.9	28.3	57.9	89.9	98.0
Size Control	1.6	3.6	21.1	60.3	97.6	100
Portfolio	6.5	7.3	28.3	61.1	95.5	100
Abnormal Return						
Size Model	4.5	5.7	23.9	57.5	95.0	99.2
Abnormal Return[d]	5.7	7.7	27.5	61.1	96.0	99.2

[a] Not clustered in calendar time means a different event date is selected for each randomly selected security. No restriction on event dates means that event dates are randomly selected from all calendar months. The sample size in all instances is 50 securities.

[b] Large (small) firm samples consist of securities randomly selected from the top (bottom) two market value portfolios (deciles).

[c] The rejection rates reported in panels A and B correspond to the percentage of 250 samples where the null hypothesis of zero abnormal performance on day 0 is rejected at the 5% level using a one-tailed t-test. Two sets of rejection rates are reported for each abnormal return measure. The first row is for an alternative hypothesis of positive abnormal performance on day 0 while the second row is for an alternative hypothesis of negative abnormal performance on day 0. For a nominal significance level of 5% and 250 simulated samples, the 95% confidence limits for the expected rejection frequency, when the null is in fact true, are 2.3% and 7.7%.

[d] Market-adjusted abnormal returns are calculated as $u_{it}-R_{it}-R_{mt}$. Market model abnormal returns are calculated as $u_{it}^{mm}=R_{it}-(\hat{\alpha}_i+\hat{\beta}_i R_{mt})$. In estimating u_{it} and u_{it}^{mm}, R_{mt} is the CRSP Equally-Weighted Market Index. Size control portfolio abnormal returns are calculated as $u_{it}^{sc}=R_{it}-R_{pt}$. Size model abnormal returns are calculated as $u_{it}^{sm}=R_{it}-(\hat{\alpha}_i^s+\hat{\beta}_i^s R_{pt})$. In estimating u_{it}^{sc} and u_{it}^{sm}, R_{pt} is the equally-weighted return on the market value portfolio (i.e., decile) of which firm i is a member. Market and size model parameters are estimated using data from all calendar months.

the expected 5% rejection rate, when the null hypothesis is in fact true, is 2.3% to 7.7%.

Focusing on Type I error rates, the null hypothesis is rejected too often when market-adjusted abnormal returns are used. Specifically, when abnormal performance is not seeded into the data, the null hypothesis is rejected 10.5% (8.5%) of the time in large (small) firm samples in favor of the alternative hypothesis of positive mean abnormal performance. Each of the remaining abnormal return measures rejects the null hypothesis of zero abnormal performance near the 5% nominal significance level (regardless of the alternative hypothesis), with one exception. In small firm samples, size control portfolio abnormal returns provide a conservative test of positive mean abnormal performance as evidenced by the 1.6% rejection rate. This is below the lower bound of the 95% confidence interval for the expected rejection rate (i.e., 2.3%).

When abnormal performance is introduced into the data, the market model, size control portfolio, and size model abnormal return methods are equally powerful in detecting it. For example, when a .5% (1%) positive abnormal return is seeded into large firm samples, the market model rejects the null hypothesis 68% (98%) of the time, while the size model rejects the null hypothesis 72.9% (98.4%) of the time. The corresponding rejection rates using size control portfolio abnormal returns are 72.1% (99.6%).

An interesting feature of the Table 2 results is that abnormal performance is detected far more often in large firm samples. For example, when using market model abnormal returns a .5% (1%) positive abnormal return is detected 68.0% (98.0%) of the time in large firm samples, but only 27.9% (60.7%) of the time in small firm samples. The rejection rates using size control portfolio abnormal returns are 72.1% (99.6%) and 21.1% (60.3%). These results occur because small firm portfolios have higher return variances than large firm portfolios (see col. 3 of Table 1).

Clustered Event Dates—Conventional t-tests

Results when event dates are clustered in calendar time are reported in Table 3.[15] Rejection frequencies based on conventional *t*-tests are reported in panel A, while those based on empirical distribution tests are reported in panel B.

Panel A indicates that in large firm samples the market-adjusted abnormal return method incorrectly rejects the null hypothesis 34.8% (27.9%) of the time relative to the alternative hypothesis of positive (negative) mean abnormal performance. The corresponding rejection rates in small firm samples are 14.2% (14.6%). These rejection frequencies are approximately 7 and 5½ times the nominal significance level of the test in large firm samples and approximately 3 times the nominal significance level of the test in small firm samples.

Tests in large firm samples that are based on market model abnormal returns, incorrectly reject the null hypothesis 13.4% (20.6%) of the time relative to the alternative of positive (negative) mean abnormal performance. These incorrect rejection frequencies are approximately 2½ and 4 times the nominal significance level of the test. The results for small firms using market model abnormal returns reveal only a slight overrejection tendency. When abnormal per-

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[15] Event dates are identical for each of the 50 firms in the sample and the common date could come from any calendar month. Later, we report results when event dates are clustered and constrained to occur in January.

TABLE 3

A COMPARISON OF ALTERNATIVE ABNORMAL RETURN MEASURES WHEN EVENT DATES ARE CLUSTERED IN CALENDAR TIME: NO RESTRICTION ON EVENT DATES[a]

Panel A. Significance of Event Date (Day 0) Abnormal Performance Based on a One-tailed t-*test* $\alpha = .05$:[c]

	Large Firms[b]						*Small Firms*					
	Rejection Rates (in percent) for Induced Abnormal Performance of:						*Rejection Rates (in percent) for Induced Abnormal Performance of:*					
Abnormal Return Measure[d]	*0*	*.1*	*.5*	*1*	*2*	*3*	*0*	*.1*	*.5*	*1*	*2*	*3*
Market-Adjusted	34.8	39.7	66.0	85.4	97.2	100	14.2	18.2	35.2	60.7	91.1	96.4
Abnormal Return	27.9	33.6	57.1	77.7	95.5	100	14.6	17.4	33.2	57.5	87.0	96.0
Market Model	13.4	20.2	65.6	95.1	99.6	100	9.3	11.3	30.4	59.5	96.4	99.1
Abnormal Return	20.6	31.2	70.0	93.9	99.6	100	6.5	8.9	30.4	59.5	93.9	94.3
Size Control	5.3	14.2	78.1	99.2	100	100	2.8	6.5	18.2	63.2	98.4	99.6
Portfolio	4.9	14.2	70.9	99.2	100	100	6.5	8.9	28.7	65.6	95.6	100
Abnormal Return												
Size Model	3.6	10.5	74.1	98.4	100	100	5.3	6.9	24.7	57.5	97.2	99.6
Abnormal Return	4.9	11.7	73.3	98.4	100	100	8.0	10.9	36.4	63.2	92.7	99.2

formance has not been seeded, the true null is rejected 9.3% of the time in favor of the alternative of positive abnormal performance.

Both the size control portfolio and size model abnormal return methods perform well in both large and small firm samples. When abnormal performance is not seeded into the data, rejection frequencies are near the 5% nominal significance level. An exception is the small firm size model abnormal returns with an alternative hypothesis of negative abnormal performance. There the rejection frequency of 8% marginally exceeds the upper bound (7.7%) of the 95% confidence interval.

When .5% and 1% positive abnormal performance is seeded in large firm samples, the rejection frequencies based on size control portfolio (size model) abnormal returns are 78.1% and 99.2% (74.1% and 98.4%). When the alternative hypothesis is negative, similar results obtain. For example, with 1% and 2% negative abnormal performance seeded into the data size control portfolio (size model), abnormal return measures reject the null hypothesis 99.2% and 100% (98.4% and 100%) of the time.

In the previous paragraph (and throughout the remainder of the paper) we refrain from: (1) discussing the power of invalid tests, and (2) comparing the power of invalid tests with the power of valid tests. By invalid tests we mean tests that commit excessive Type I errors (e.g., the market-adjusted and market model abnormal return methods in panel A of Table 3). It is our belief that power is an issue only when a researcher is making a choice among a set of valid tests. Accordingly, we do not emphasize the relatively high rejection frequencies for some tests based on market-adjusted and market model abnormal returns when the alternative hypothesis is true because such tests reject a true null hypothesis an excessively large number of times.

Finally, note that the results in Table 3

TABLE 3—*Continued*

Panel B. Significance of Event Date (Day 0) Abnormal Performance Based on an Empirical Distribution of the Particular Abnormal Return Measure—Empirical Distributions Based on Data From All Calendar Months:[d]

Abnormal Return Measure[e]	*Large Firms*						*Small Firms*					
	Rejection Rates (in percent) for Induced Abnormal Performance of:						*Rejection Rates (in percent) for Induced Abnormal Performance of:*					
	0	*.1*	*.5*	*1*	*2*	*3*	*0*	*.1*	*.5*	*1*	*2*	*3*
Market-Adjusted Abnormal Return	3.2	5.3	13.0	32.4	84.2	96.8	6.1	7.7	12.1	25.1	70.9	95.5
	5.3	6.9	13.8	30.4	85.8	98.4	3.6	4.0	10.9	24.3	68.8	92.3
Market Model Abnormal Return	3.6	6.5	32.8	86.6	99.6	100	4.0	7.3	12.0	47.8	97.2	100
	6.9	10.1	44.1	91.9	99.6	100	3.6	4.9	19.0	57.9	96.8	99.6
Size Control Portfolio Abnormal Return	4.9	11.7	75.7	99.6	100	100	1.2	3.2	23.1	59.1	97.6	100
	3.6	9.7	71.7	100	100	100	6.1	8.1	25.1	64.4	99.2	99.6
Size Model Abnormal Return	4.0	11.7	77.7	99.2	100	100	6.1	7.7	26.3	57.9	98.0	100
	4.9	11.3	80.6	100	100	100	3.6	7.7	28.3	62.8	98.4	100

[a] Clustered in calendar time means the event date is identical for all firms in the sample. No restriction on event dates means that event dates are randomly selected from all calendar months. The sample size in all instances is 50 securities.

[b] See Table 2, footnote b.

[c] The rejection rates reported in panel A correspond to the percentage of 250 samples where the null hypothesis of zero abnormal performance on day 0 is rejected at the 5% level using a one-tailed t-test. Two sets of rejection rates are reported for each abnormal return measure. The first row is for an alternative hypothesis of positive abnormal performance on day 0 while the second row is for an alternative hypothesis of negative abnormal performance on day 0. For a nominal significance level of 5% and 250 simulated samples, the 95% confidence limits for the expected rejection frequency, when the null is in fact true, are 2.3% and 7.7%.

[d] The rejection rates reported in panel B correspond to the percentage of 250 samples where the null hypothesis of zero abnormal performance on day 0 is rejected at the 5% level using an empirical distribution of the particular abnormal return measure. Two sets of rejection rates are reported for each abnormal return measure. The first row is for an alternative hypothesis of positive abnormal performance on day 0 while the second row is for an alternative hypothesis of negative abnormal performance on day 0. For an alternative hypothesis of positive (negative) abnormal performance the null hypothesis of zero abnormal performance is rejected if the mean sample abnormal return on day 0 exceeds (is less than) the 95th (5th) percentile of the empirical distribution of the particular abnormal return measure. Section II describes how the empirical distributions are generated. For a nominal significance level of 5% and 250 simulated samples, the 95% confidence limits for the expected rejection frequency, when the null is in fact true, are 2.3% and 7.7%.

[e] See Table 2, footnote d.

are consistent with the results in Table 2 in that abnormal performance is detected far more often in large firm samples than in small firm samples. For example, with a .5% and 1% positive abnormal performance seeded into the data, the null hypothesis is rejected 78.1% and 99.2% of the time in large firm samples and 18.2% and 63.2% of the time in small firms samples when size control portfolio returns are used. Corresponding rejection frequencies based on size model abnormal returns are 74.1% and 98.4% for large firm and 24.7% and 57.5% in small firms. Furthermore, comparison of the rejection frequencies reported in Table 2 (non-clustered event dates) with those in panel A of Table 3 (clustered event dates) reveals that the power of the tests is not altered dramatically by moving from non-clustered to clustered event dates.[16]

Clustered Event Dates—Empirical Distribution Tests

Panel B of Table 3 reports the rejection frequencies of significance tests that are based on empirical distributions of the four abnormal return measures. In the absence of abnormal performance, all four approaches commit Type I errors within the 95% confidence interval for the expected rejection frequency (with one exception to be discussed shortly). This result holds for large and small firm portfolios and for alternative hypotheses of positive and negative abnormal performance. For example, in small firm samples the null hypothesis is rejected 4.0% (3.6%) of the time in favor of the alternative of positive (negative) abnormal performance when market model abnormal returns are used. The corresponding rejection frequencies using size model abnormal performance measures are 6.1% (3.6%). A compelling aspect of the results in large firm samples is that a significance test based on an empirical distribution of market-adjusted or market model abnormal returns alleviates the excessive Type I error rates observed for these abnormal return measures in panel A. However, as noted below, this reduction in Type I errors comes at the cost of reduced power. Finally, in small firm samples an empirical distribution test based on size control portfolio abnormal returns is conservative. This conclusion is based on the observed 1.2% rejection frequency under an alternative hypothesis of positive mean abnormal performance. This rejection frequency falls below the lower bound of the 95% confidence interval for the expected rejection rate (i.e., 2.3%).

An apparent dominant strategy seems to emerge by examining the rejection frequencies in cases where abnormal return has been seeded into the data. First, note that while empirical distribution tests based upon market-adjusted or market model abnormal returns in large firm samples do not exhibit the excessive Type I error rates of their conventional *t*-test counterparts, they are considerably less powerful in detecting abnormal performance than the empirical distribution tests that use a size-adjusted metric. For example, in large firm samples, .5% (1%) positive abnormal performance is detected 13.0% (32.4%) of the time when significance tests are based on an empirical distribution of market-adjusted abnormal returns, and 32.8% (86.6%) of the time based on an empirical distribution of market model abnormal returns. These are considerably less than the rejection rates of 75.7% (99.6%) based on an empirical distribution of size control portfolio abnormal returns. The inference here is straightforward. In large firm samples, acceptable Type I error rates based on empirical distributions of market-adjusted and market model abnormal returns come at a cost of lower power relative to other valid tests. Second, rejection frequencies using size control portfolio and size model abnormal returns are comparable between panels A and B for both large and small firm samples. Collectively, these results indicate that when size and event date clustering exist, a conventional *t*-test with size control portfolio or size model abnormal returns provide a valid test with power comparable to any of the empirical distribution tests.

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[16] It is important to note that in both contexts the event date is known with certainty.

TABLE 4

A COMPARISON OF ALTERNATIVE ABNORMAL RETURN MEASURES WHEN EVENT DATES ARE CLUSTERED IN CALENDAR TIME AND CONSTRAINED TO OCCUR IN JANUARY[a]

Panel A. Significance of Event Date (Day 0) Abnormal Performance Based on a One-tailed t-test $\alpha = .05$:[c]

	Large Firms[b]						*Small Firms*					
	Rejection Rates (in percent) for Induced Abnormal Performance of:						*Rejection Rates (in percent) for Induced Abnormal Performance of:*					
Abnormal Return Measure	*0*	*.1*	*.5*	*1*	*2*	*3*	*0*	*.1*	*.5*	*1*	*2*	*3*
Market-Adjusted	32.8	40.5	68.0	84.6	97.6	100	32.8	38.1	55.1	76.1	96.4	99.2
Abnormal Return	22.7	27.9	54.7	81.4	95.1	98.8	10.9	13.8	21.9	37.2	73.3	87.4
Market Model	5.7	11.3	50.2	86.2	97.6	100	11.3	15.4	34.8	68.0	98.0	100
Abnormal Return	29.6	37.7	79.4	98.8	100	100	5.7	6.9	24.7	48.6	87.4	96.4
Size Control	6.5	11.3	78.1	98.8	100	100	2.4	4.5	18.6	56.7	96.0	99.2
Portfolio	2.4	6.9	68.0	97.2	100	100	8.9	13.0	29.6	66.0	94.7	98.4
Abnormal Return												
Size Model	4.5	13.4	69.6	97.6	100	100	4.8	6.0	24.7	61.5	97.2	97.2
Abnormal Return	7.3	14.6	73.7	98.0	100	100	4.9	7.7	30.0	57.5	91.3	98.0

Panel B. Significance of Event Date (Day 0) Abnormal Performance Based on an Empirical Distribution of the Particular Abnormal Return Measure—Empirical Distributions Based on Data From All Calendar Months:[d]

	Large Firms						*Small Firms*					
	Rejection Rates (in percent) for Induced Abnormal Performance of:						*Rejection Rates (in percent) for Induced Abnormal Performance of:*					
Abnormal Return Measure	*0*	*.1*	*.5*	*1*	*2*	*3*	*0*	*.1*	*.5*	*1*	*2*	*3*
Market-Adjusted	4.9	5.7	13.4	33.6	86.2	97.6	16.2	18.6	27.5	44.1	77.7	96.8
Abnormal Return	5.7	6.5	11.7	33.2	84.6	98.4	2.4	3.2	8.9	19.4	52.6	81.4
Market Model	2.4	4.0	20.6	77.3	97.6	99.6	9.7	11.7	25.1	58.7	97.2	99.6
Abnormal Return	10.9	16.9	57.5	94.7	100	100	3.2	3.6	13.0	45.7	91.9	98.8
Size Control	6.9	13.0	75.3	99.2	100	100	4.5	7.7	18.6	57.5	98.0	100
Portfolio	4.5	11.7	74.1	100	100	100	6.1	10.1	29.1	69.6	98.8	99.6
Abnormal Return												
Size Model	4.9	10.1	72.1	99.2	100	100	6.5	7.3	21.9	61.5	96.4	100
Abnormal Return	6.5	15.8	80.2	100	100	100	8.9	11.3	27.9	63.2	98.4	100

[a] Clustered in calendar time and constrained to occur in January means the event date is identical for all firms in the sample and is in January. The sample size in all instances is 50 securities.

[b] See Table 2, footnote b.

[c] See Table 3, footnote c.

[d] See Table 3, footnote d.

Event Dates Constrained to Occur in January—Conventional t-tests

Simulation results when event dates are constrained to occur in January are reported in Table 4. As noted above, the motivation for these simulations is to provide a severe test of the size control portfolio and size model methods, given the firm size effect is most pronounced in January [Keim, 1983].[17]

With respect to the Type I error rates for conventional *t*-tests (panel A), several interesting results emerge. First, not surprisingly, test statistics based on market-adjusted abnormal returns are unreliable. For example, in large firm samples, the true null hypothesis is rejected 32.8% (22.7%) of the time in favor of the alternative of positive (negative) mean abnormal performance. The corresponding rejection frequencies in small firm samples are 32.8% (10.9%). These Type I error rates range from 2 to 6½ times the nominal significance level. Second, in large firm samples market model abnormal performance measures incorrectly reject the null hypothesis in favor of negative abnormal performance 29.6% of the time. This is approximately 6 times the nominal significance level.[18] In small firm samples, the null hypothesis is rejected 11.3% of the time in favor of positive abnormal performance when market model abnormal returns are analyzed. This Type I error rate is more than 2 times the nominal significance level of the test. These over-rejection rates in large (small) firm samples, when the alternative hypothesis is of negative (positive) abnormal performance are consistent with the results in Keim [1983] where market model abnormal returns were, on average, negative (positive) throughout January.[19]

The rejection frequencies for both large and small firm samples, when abnormal performance has not been introduced into the data, reveal that conventional *t*-statistics based on size model abnormal returns are well-specified. Thus, while market model abnormal performance measures commit Type I errors 2 to 6½ times the nominal significance level, size model rejection frequencies are within the 95% confidence interval for the expected rejection frequency. With respect to the rejection frequencies based on size control portfolio abnormal returns, three of four are within the 95% confidence interval for the expected rejection rate. The exception, 8.9% in small firm samples with an alternative hypothesis of negative abnormal performance is puzzling, especially in light of the 4.9% rejection rate based on size model abnormal returns. Finally, the rejection frequencies reported in Table 4 (January event dates) using size control portfolio or size model abnormal returns are comparable with those reported in Table 3 (all months), which indicates that either method effectively controls for the impact of firm size on expected returns regardless of when the event occurs.

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[17] The rejection frequencies using market model abnormal returns will also be of interest because studies by Dukes [1978] and Salatka [1988] on the issue of foreign currency translation (SFAS No. 8) had event dates in January.

[18] The excessive Type I error rate for large firms in panel A of Table 3 is not unduly influenced by that reported in panel A of Table 4. While we did not perform the simulations in Table 3 using only non-January months, we can show that the results in Table 3 are not driven by those in Table 4. For example, using market model abnormal returns, out of 250 event dates, 21 (1/12 × 250) are expected to occur in January. Also, note that the 20.6% rejection frequency reported in Table 3 translates into 52 event dates (.206 × 250). Consider the following two scenarios. First, assume that the null hypothesis was rejected on all 21 January event dates. This leaves 31 rejections in non-January months out of the remaining 229 (250 − 21) samples. This translates into a rejection frequency of 13.5% (31/229). Assume instead (and more realistically with knowledge of the 29.6% rejection frequency for January event dates from Table 4), that the null hypothesis was rejected on 29.6% of the 21 January event dates (i.e., 6.3 times). In this second scenario the number of rejections in non-January months is estimated to be 45 (52 − 7) out of the remaining 243 (250 − 7) samples. This translates into a rejection frequency of 18.5% (45/243). Thus, results reported in panel A of Table 3 cannot be attributed to those in panel A of Table 4.

[19] We were able to reproduce Keim's results using our data. The average abnormal return on a portfolio of small (large) firms was positive (negative) on every trading day in January using data from 1964–1982. These results are available upon request.

In large firm samples, with .5% and 1% positive abnormal performance seeded into the data, conventional t-tests based upon size control portfolio (size model) abnormal performance measures reject the null hypothesis 78.1% and 98.8% (69.6% and 97.6%) of the time. The corresponding rejection frequencies of a conventional t-test based upon market model abnormal returns are 50.2% and 86.2%. In small firm samples power differences seem less pronounced.

Event Dates Constrained to Occur in January—Empirical Distribution Tests

The results in Table 4, panel B reveal that the excessive Type I error rates observed in panel A are not eliminated using empirical distribution tests. The following over-rejection tendencies still emerge: (1) the true null hypothesis is rejected 16.2% of the time in small firm samples when market-adjusted abnormal returns are used, (2) the true null hypothesis is rejected 10.9% of the time in large firm samples when market model abnormal returns are used, and (3) the true null hypothesis is rejected 9.7% of the time in small firm samples when market model abnormal returns are used. Initially, these results seem puzzling because one expects significance tests based on empirical distributions to conform well to nominal significance levels. However, the problem manifested in these excessive Type I error rates is clearly that the unusual nature of January returns is *not* reflected in our empirical distributions. The rejection frequencies reported in panel B are based on empirical distributions generated using data from *all* calendar months. An obvious alternative is to generate empirical distributions using only data from January and then use the 5th and 95th percentiles of it in conducting significance tests. We performed such an analysis and found the test statistics to be well-specified.[20] However, the Type I error rates reported in panel B show that significance tests based on empirical distributions will be misspecified unless properties of the return distribution during the event period (in this case the uniqueness of the January return distribution) are reflected in the generated empirical distribution.[21]

Consistent with the results for large firm samples in Table 3, empirical distribution tests based on market-adjusted and/or market model abnormal returns reject a false null hypothesis considerably less often than the size-based methods. For example, positive abnormal performance of .5% (1%) is detected 13.4% (33.6%) of the time using market-adjusted abnormal returns, and 20.6% (77.3%) of the time using market model abnormal returns. The corresponding rejection frequencies based on size control portfolio (size model) abnormal returns are 75.3% and 99.2% (72.1% and 99.2%). In small firm samples power comparisons involving positive abnormal performance are difficult to make given the misspecification of the market-adjusted and market model abnormal return methods. With respect to the power of the test to detect negative abnormal performance, the size-based methods are superior to the market-adjusted and market model methods in small firm samples.

Finally, consistent with Table 3, the power of the size-based methods is not sensitive to the form of the significance tests. For example, when size control portfolio abnormal returns are examined in small firm samples, 1% positive (negative) abnormal performance is detected 56.7% (66.0%) of the time using a simple *t*-test (panel A) and 57.5% (69.6%) when an empirical distribution test is used (panel B). The corresponding rejection rates in large firm samples are 98.8% (97.2%) and 99.2% (100%). In conclusion, the results in Table 4 are consistent with those in Table 3 in that a simple *t*-test based on size control portfolio or size model abnormal performance measures is both well-specified and powerful across a variety of event conditions. Since the size control portfolio approach is simpler to implement than the size model, the former is the preferred alternative.

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[20] These results are available from the authors.

[21] For example, if empirical distribution tests are used to assess the significance of the abnormal returns associated with a Monday or Friday event date, the empirical distribution may need to account for the day-of-the-week effect (see e.g., French [1980] and Keim and Stambaugh [1984]).

Implications of Cross-Sectional Dependence

In Section II we state that in the absence of industry clustering, a conventional *t*-test assuming cross-sectional independence in abnormal returns should be well-specified and potentially more powerful than a test statistic attempting to take cross-sectional dependencies into account. In this section we examine the independence assumption in detail to determine whether the excessive Type I error rates observed above can be attributed to cross-sectional dependence in the various abnormal return measures.

Table 5 reports deciles of the distribution of pairwise cross-correlations based on the four abnormal return measures. Cross-correlations are reported for large and small firm samples for two sub-periods of the overall 1964–1982 period.[22] The large firm market-adjusted abnormal return deciles reveal that in both sub-periods the median is positive (.123 and .204, respectively). For small firm samples the median values are .052 and .046. Thus, not surprisingly, simply subtracting the market return does not purge cross-correlation from the data. With respect to the cross-correlations among the large firm market model abnormal returns, the median is positive in both sub-periods (.031 and .017). We show below that this degree of cross-correlation is large enough to affect the standard error estimate used in conventional *t*-tests. The cross-correlations among market model abnormal returns in small firm samples are centered on zero. The median pairwise cross-correlation in the 1964–1972 (1973–1982) sub-period is .003 (.002).

Examination of the deciles of pairwise cross-correlations among size control portfolio abnormal returns reveals that, in both sub-periods and for both large and small firm samples, the distributions are centered on zero. In large firm samples the median cross-correlation is .002 (−.002) in the 1964–1972 (1973–1982) sub-period. The corresponding values in small firm samples are −.007 and .002. The cross-correlations in large or small firm samples using size model abnormal returns are also centered on zero. The median cross-correlations in the two sub-periods are −.003 and −.004 for both large and small firms.

The positive cross-correlation among the market model abnormal returns of large firms contributes to the excessive Type I error rates observed in Tables 3 and 4. Moreover, since market model abnormal performance measures do not lead to excessive Type I errors when event dates are *not* clustered in calendar

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[22] These distributions are constructed as follows. Every year from 1964–1982 randomly select 50 large (small) firms, without replacement, and compute the 1,225 (50×49/2) unique pairwise cross-correlations using 200 daily abnormal returns. The distribution for the 1964–1972 (1973–1982) sub-period is based on 11,025 (12,250) pairwise cross-correlations.

TABLE 5

DISTRIBUTION OF PAIRWISE CROSS-CORRELATIONS FOR THE FOUR ABNORMAL RETURN MEASURES[a,b]

Panel A. Time Period 1964–1972:

	Market-Adjusted Abnormal Returns			*Market Model Abnormal Returns*			*Size Control Portfolio Abnormal Returns*			*Size Model Abnormal Returns*	
Decile	*Small Firms*	*Large Firms*	*Decile*	*Small Firms*	*Large Firms*	*Decile*	*Small Firms*	*Large Firms*	*Decile*	*Small Firms*	*Large Firms*
Min	−.255	−.164	Min	−.287	−.301	Min	−.321	−.337	Min	−.285	−.278
10%	−.042	.010	10%	−.088	−.075	10%	−.092	−.105	10%	−.099	−.100
20%	−.010	.046	20%	−.058	−.040	20%	−.063	−.069	20%	−.067	−.067
30%	.012	.074	30%	−.035	−.012	30%	−.041	−.043	30%	−.043	−.042
40%	.033	.099	40%	−.015	.009	40%	−.024	−.021	40%	−.023	−.023
50%	.052	.123	50%	.003	.031	50%	−.007	.002	50%	−.003	−.003
60%	.073	.148	60%	.023	.054	60%	.010	.018	60%	.016	.016
70%	.095	.175	70%	.042	.077	70%	.027	.039	70%	.036	.038
80%	.122	.209	80%	.066	.104	80%	.046	.065	80%	.060	.061
90%	.160	.255	90%	.101	.147	90%	.069	.100	90%	.094	.096
Max	.492	.731	Max	.339	.778	Max	.105	.555	Max	.437	.627

TABLE 5—*Continued*

Panel B. Time Period 1973–1982:

	Market-Adjusted Abnormal Returns			*Market Model Abnormal Returns*			*Size Control Portfolio Abnormal Returns*			*Size Model Abnormal Returns*	
Decile	*Small Firms*	*Large Firms*	*Decile*	*Small Firms*	*Large Firms*	*Decile*	*Small Firms*	*Large Firms*	*Decile*	*Small Firms*	*Large Firms*
Min	−.236	−.325	Min	−.272	−.257	Min	−.275	−.357	Min	−.309	−.302
10%	−.044	.064	10%	−.093	−.080	10%	−.090	−.118	10%	−.096	−.108
20%	−.013	.112	20%	−.061	−.048	20%	−.059	−.078	20%	−.064	−.073
30%	.009	.147	30%	−.037	−.024	30%	−.039	−.048	30%	−.042	−.046
40%	.028	.176	40%	−.016	−.003	40%	−.020	−.025	40%	−.022	−.025
50%	.046	.204	50%	.002	.017	50%	.002	−.002	50%	−.004	−.004
60%	.064	.230	60%	.021	.036	60%	.015	.021	60%	.015	.017
70%	.084	.260	70%	.041	.057	70%	.033	.045	70%	.035	.040
80%	.108	.295	80%	.066	.082	80%	.056	.075	80%	.060	.066
90%	.141	.346	90%	.100	.118	90%	.087	.123	90%	.092	.103
Max	.359	.717	Max	.439	.658	Max	.386	.500	Max	.318	.707

[a] Pairwise cross-correlations are estimated for each of the four abnormal return measures as follows. Every year from 1964–1982 (19 in total) 50 firms are randomly selected and the 1,225 (50×49/2) unique pairwise cross-correlations are estimated. The distributions in the 1964–1972 (1973–1983) sub-period are based on a sample of 11,025 (12,250) pairwise cross-correlations.

[b] See Table 2, footnote b.

time, the over-rejections are not caused by biased abnormal returns (i.e., the numerator of the *t*-statistic).

The bias in the standard error used to compute the *t*-statistic can be approximated using the following formula [Collins and Dent, 1984, pp. 52–54]:

$$\frac{\sigma(Independence)}{\sigma(Dependence)} \approx \frac{1}{\sqrt{1+(N-1)\rho}},$$

where $\sigma(Independence)$ is the standard error of the sample mean abnormal return assuming cross-sectional independence, $\sigma(Dependence)$ is the standard error of the same assuming non-zero cross-sectional dependence, N equals the number of firms in the sample (i.e., 50), and ρ is the level of pairwise cross-correlation assumed the same across firm-pairs.

Using the median cross-correlation among the market model abnormal returns of large firms as a measure of ρ, standard errors based upon the assumption of independence are, on average, approximately 63% (74%) of their true value during the 1964–1972 (1973–1982) sub-period. This result indicates that cross-correlation in market model abnormal returns presents a problem not only when there is industry and calendar time clustering in the sample, but also when there is calendar time clustering and the sample is comprised predominantly of large firms. Since size control portfolio and size model abnormal returns are not correlated cross-sectionally, either method controls for cross-sectional dependence in such samples.

While the excessive Type I error rates in large firm samples can be attributed, in part, to cross-sectional dependence in the market model abnormal returns of such firms, the excessive Type I error rates for small firms cannot. Since cross-correlation does not discriminate between positive and negative abnormal performance (i.e., ignoring positive cross-correlation always downward biases standard error estimates), the excessive rejection frequencies for small firms must stem from biased mean abnormal returns. Since size control portfolio and size model abnormal returns in small firm samples do not exhibit similar tendencies, either provides a parsimonious control for the excessive Type I error rates of the market model method.

IV. SUMMARY AND CONCLUSIONS

In this study we compare the performance of four alternative measures of abnormal return using conventional *t*-tests and tests based on empirical distributions. Our results indicate that when event dates are clustered in calendar time and samples are composed of only large (small) firms, conventional *t*-tests using market-adjusted or market model measures of abnormal performance are misspecified. Their empirical Type I error rates range from 2 to 7 times the nominal significance level of the test. In contrast, a conventional *t*-test based on size control portfolio or size model abnormal performance measures yields Type I error rates within tolerable limits of the nominal significance level of the test.

Significance tests based on empirical distributions of market-adjusted or market model abnormal returns control for the excessive Type I error rates. However, such tests are, surprisingly, less powerful than *t*-tests based on size-adjusted metrics in detecting abnormal performance. Since conventional *t*-tests based on either size control portfolio or size model abnormal performance measures yield acceptable Type I error rates (even when event dates are constrained to occur in January), either controls for the firm size effect in event study contexts. However, since size control portfolio abnormal returns are easier to estimate when compared with size model abnormal returns (i.e., no regressions need to be estimated), the former is simpler to implement.

Other results of the study are as follows. First, the simulation results indicate that abnormal performance is more often detected in large firm samples than it is in small firm samples. Second, the study documents that the market model abnormal returns of large firms are positively cross-correlated. This contributes, in part, to the excessive Type I error rates documented and suggests that cross-sectional correlation may be problematic not only in samples clustered by industry and in calendar time, but also when samples are restricted to large firms at a common calendar time. Since size-based abnormal performance measures do not exhibit similar cross-correlation tendencies, they control for cross-sectional dependencies in the market-adjusted return metrics of large firm samples. In conclusion, this study's results have implications for event studies in which control for the firm size effect is warranted. In such contexts a conventional *t*-test based upon size control portfolio abnormal returns is valid and of equal or greater power than alternative testing procedures.

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The Information in Governmental Annual Reports: A Contemporaneous Price Reaction Approach

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ABSTRACT: Considerable evidence exists that governmental accounting numbers are related empirically to bond risk and return measures. However, prior research does not preclude the possibility that accounting numbers merely reflect unobserved factors such as economic and political attributes impounded in bond measures. This study considers whether governmental annual financial reports convey new information directly to the bond market. Changes in bond prices during the period around the release date of governmental annual reports were examined to assess market responses to the reports. No significant evidence was obtained to suggest that municipal bond investors use the information in the annual report at the time of its release to adjust bond prices. In contrast, new bond issues and bond rating announcements were associated with significant market reactions. Thus, these results indicate that, while issuer-specific accounting information may be used by bond investors in conjunction with decisions involving new issues and rating evaluations, investors do not appear to impound the information directly into secondary market prices at the time the information is released.

THERE is considerable evidence that governmental accounting data are related empirically to bond market measures (e.g., interest cost on new bond issues) and, thus, are potentially useful to bond investors (for a review, see Ingram et al. [1987]). However, the methods and data used in prior research do not preclude the possibility that unobserved attributes, such as economic and political factors, may influence simultaneously both accounting numbers and bond measures. In other words, it is not clear from prior research whether accounting data merely *reflect* other factors impounded in bond measures or whether accounting data *convey* new information to the market.

The objective of this study is to examine whether governmental annual reports convey information to the bond market by observing the market reaction at the time the financial reports are released. Although the Governmental Accounting Standards Board (GASB) is actively involved in improving reporting standards, very little is known currently about the information content of governmental ac-

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counting reports or of how efficiently the market impounds this information in security prices.[1] Therefore, this research is relevant to policy decisions affecting governmental accounting and financial reporting.

The next section reviews methods used in previous research for assessing the new information in accounting reports and the applicability of these methods to governmental accounting research. The third section identifies our sample and describes the empirical tests. The results of these tests and their implications are discussed in the final two sections.

ASSESSING INCREMENTAL INFORMATION

Starting with Ball and Brown [1968] and Beaver [1968], numerous studies in the corporate literature have tested the association between earnings announcements and the mean and variance of abnormal rates of return. Ball and Brown examined annual earnings announcements and found that 85–90 percent of the stock price change associated with unexpected earnings occurred before the month of announcement. The earlier price adjustment may be attributed to alternative sources of information (quarterly reports and nonaccounting sources of information). Beaver [1968] examined the variance of the abnormal rate of return as an alternative measure of stock price reaction to earnings announcements. An increase in contemporaneous security return variability suggests that the information in the announcement caused a revision of beliefs and prices. The advantage in using a variance test of earnings information is that it obviates the need to specify an earnings expectation model and, thus, avoids errors in measuring the direction of expected price reaction. Subsequently, Ohlson [1979] provides a theory as to why the variance of stock returns can be used to measure incremental information. In particular, he suggests that price variability associated with a particular disclosure is an inverse function of the frequency of other disclosures. Consistent with this proposition, McNichols and Manegold [1983] provide some evidence that greater price variance is associated with the release of corporate annual reports in an environment in which there is no quarterly reporting.

A variance test as a measure of security price reaction to the release of accounting data is particularly appropriate for the public sector, given the lack of a convenient "bottom-line" measure of performance such as earnings. Governmental resources are typically segregated into a number of "funds," and the measurement focus is *not* capital maintenance (i.e., revenues minus *expenses*). Instead, the major financial objective is generally to break even based on the inflow and outflow of spendable resources. Therefore, it is difficult to construct an unambiguous single measure of expected performance for governments that is comparable to corporate earnings.

While early corporate research focused on the information in earnings announcements, evidence from later research (e.g., Foster and Vickrey [1978] and Wilson [1986, 1987]) suggests that the formal releases of accounting data such as the Form 10K or components of earnings released in the annual financial report do indeed possess *incremental* information over earnings announcements or other less formal sources of information. Bernard and Stober [1987], however, provide empirical results that generally do not find incremental information in some earnings components as found in the previous studies. In particular, Bernard and Stober's results indicate no consistent differences between the market effects of cash flow and current accrual components. In contrast to the corporate literature, no evidence exists in the governmental sector regarding market reaction to either "bottom-line" or component measures.

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[1] The GASB [1987] has identified "investors and creditors" as a primary user group for governmental financial reports. This user group also includes information intermediaries such as rating agencies, as well as organized interests such as underwriters and financial institutions. The activities of all these individuals competing under conditions of uncertainty should be captured by market prices.

The government environment is characterized by relatively few alternative formal or informal sources of financial information to the annual report. Whereas press releases appear regularly and frequently in the national financial press for many publicly traded corporations, that is not true for local governments. Unlike corporate entities there are no requirements for municipalities to report interim performance or significant events to investors. Also, professional analysts do not commonly publish projected annual financial performance measures for local governments. While it is true that many governments provide beginning of the year budgets to bond rating agencies, deviations of the actual revenues and expenditures from the budgeted amounts cannot be interpreted unambiguously as a performance measure. Also, even though some (mainly larger) municipalities issue bonds almost every year, the financial information contained in their official offering statements (prospectuses) is typically extracted from prior-year audited financial statements. However, cities may provide preliminary unaudited financial information to institutional investors, and some cities include such information in their official statements.

Given this environment of fewer alternative disclosures, one would expect the release of governmental annual reports to be associated with revisions in government bond prices at the time of the release if the reports contain new information and if the markets are efficient.[2] This study is, therefore, a test of the joint hypothesis that local government annual reports contain information useful to bond investors and that the market for these bonds is informationally efficient in the semi-strong form.

RESEARCH METHODS

Sample Selection

Our sample consisted of 153 U.S. cities (of over 25,000 population) for which time-series bond price data were available from IDS,[3] and annual report release dates were available from a mail survey. Since the cities were selected on the basis of data availability and limited to cities that have long-term bonded debt outstanding rather than random sampling, care must be taken in generalizing the results.[4] Given the size and debt attributes of the sample, market responses to the release of annual reports may be stronger for the sample than for other cities. However, Atiase [1985] provides evidence in the corporate area that market reaction to information disclosures is stronger for small firms than for large firms based on the theory that there are fewer alternative sources of information for small firms. Since alternative disclosures for cities are few, no strong size effect is predicted although annual report disclosures by larger cities that issue bonds more frequently may contain less "surprise" than those by smaller cities.

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[2] The results of a mail survey of cities disclosed that annual financial reports are mailed to the bond rating agencies by virtually all cities and to institutional investors and others (e.g., bond insurance agencies) by 85.4 percent of the cities. However, an examination of various standard reference sources [Lamb and Rappaport, 1987; Public Securities Association, 1981; and Fabozzi and Pollack, 1987] provided little information about the extent to which or how these reports are actually used by investors or about other competing sources of information.

[3] These prices were obtained from Interactive Data Services, Inc., New York. Ingram [1985] evaluated extensively the econometric properties of these data and concluded that they conform well to the major theoretical and empirical assumptions which underlie similar corporate capital markets research.

[4] Cities in the sample were larger than other cities over 25,000 population and also had more debt outstanding, on average. Using the U.S. Census Bureau's regional classification scheme, the sample used in this study was over-represented by cities in the North Central region (38.5 percent vs. 30.4 percent for the total population) and the South region (34.3 percent vs. 27.2 percent for the population) and under-represented by the Northeast region (11.9 percent vs. 17.1 percent) and the West region (15.4 percent vs. 24.6 percent). Overall, these compari-

Only one bond was selected for each city; hence, the number of bonds is equal to the number of cities (153). End of month prices were available for these bonds for the period from January 1978 to September 1987. The bonds were noncallable, noninsured, general obligation bonds with an average maturity of approximately 20 years.

Using the IDS data instead of actual transaction data is an inherent limitation of the study. The data may only partially capture market reaction to events. Because of this limitation, we present findings later in the paper about the sensitivity of this institutional price data to events known to be of interest to bond investors.

Research Design

If accounting information is used by investors to assess bond risk and return, greater price revisions are likely to be observed during periods when new information is released. This rationale has provided the basis for several corporate studies of contemporaneous market reaction to the release of financial information. Beaver [1968], May [1971], Patell [1976], McNichols and Manegold [1983], Chambers and Penman [1984], Atiase [1985], and Ohlson and Penman [1985] all examined the variability of price changes in response to particular information releases. Of these studies, May [1971] and Chambers and Penman [1984] examined absolute residual returns rather than the variance of returns in order to avoid the potentially distorting effect of outliers.

This study also utilizes absolute residual returns as a measure of the variability of abnormal returns. In addition, we examine and report results using standardized squared residuals following procedures described by Patell [1976]. A three-step approach was used, as follows. First, simple market model regressions were estimated for all bonds in the sample using mean returns for 377 municipal bonds as a proxy for the market index.[5] These regressions used individual bond returns and market index returns for a 60-month estimation period (36 months preceding and 24 months following a nine-month window surrounding the annual report release month). Second, the market model parameter estimates were used to calculate residual returns (prediction errors) during this nine-month window. The nine-month window included a three-month test period (consisting of t_0, the report release month, and months t_{-1} and t_{+1}) and two three-month comparison or "non-an-

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sons indicate a selection bias toward larger, more heavily leveraged cities, and a somewhat different regional distribution of cities in our sample than in the nation as a whole.

[5] Ingram [1985] tested seven different market index proxies and found that the results were not sensitive to the proxy selected. We preferred a bonds-only index here in order to avoid the negative betas which often result from including equity securities in the index. Also, inclusion of only tax-exempt bonds in the index should minimize noise due to tax effects even though capital gains on these bonds are taxable. Thus, the index proxy we used was the mean monthly return for all 377 rated bonds in our data base, which was the same one used by Ingram except that his sample had fewer bonds and his price data only extended through 1983.

nouncement intervals" (months t_{-4} to t_{-2} and t_{+2} to t_{+4}). Return variability for the test period was compared to that for the comparison non-announcement intervals defined as a preannouncement interval (t_{-4} to t_{-2}) and postannouncement interval (t_{+2} to t_{+4}). Thus, the periods used for estimating the market model parameters were t_{-40} to t_{-5} and t_{+5} to t_{+28}.[6] Finally, in the third step, statistical tests were performed to compare the variability of abnormal returns for the test and comparison intervals, as explained below.

To determine the month in which the annual report was mailed, questionnaires were sent to the finance directors of the 377 cities for which we had time-series bond price data.[7] The questionnaires requested information about each city's fiscal year-end; the date on which their annual report was mailed; whether they had provided any unaudited financial information to bond rating agencies, financial institutions, or institutional investors prior to the normal mailing of the annual report; and whether or not copies of the annual report were mailed to these market participants. Usable responses were received after one follow-up mailing from 228 cities for a 60.5 percent response rate. However, missing information for some years and insufficient time-series price data for some bonds, reduced the final sample to 702 report releases over the period 1982 to early 1987 for 153 cities.

The distribution of report releases by calendar year and month and by relative reporting lag is given in Table 1.

Table 1 (panel A), indicates that the annual report mailing dates are diversified across time. In contrast, the distribution of fiscal year-ends is much more clustered with 327, 179, 131, and 30 of the 702 year-ends occurring on June 30, December 31, September 30, and April 30, respectively. The remaining months accounted for ten or fewer fiscal year-ends. Panel B of Table 1 reflects the diversity of mailing lags implicit from panel A, given the clustering of fiscal year-ends. Over 80 percent of the report mailings occur from four to seven months after the fiscal year-end, with the modal lag being six months.

The questionnaire data revealed that most of the cities in the sample provide annual financial reports to rating agencies (96.6 percent) and institutional investors (85.4 percent). In 30.7 percent of the cases over the five-year period (1982–1986), cities indicated they mailed unaudited preliminary financial information to market participants. However, 95.6 percent of these cases involved a new bond offering. Virtually no cities sent interim financial data, such as quarterly reports, to bond market participants or other external users. These results are consistent with arguments that municipal financial information is available to the bond market only on an infrequent basis, mainly at the time of the annual report release and during the

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[6] To reduce the potential effects of parameter nonstationarity, we preferred an estimation interval that straddled the test periods. Moreover, we wished to use five years of data to estimate the market model parameters. Since the report release dates occurred at various points over the interval 1982 to 1986 and time-series price data were available only for 1978 to 1987, a decision was made to use 36 months before the pretest interval and 24 months following the posttest interval. For years 1984 and after, however, 60 months prior to the pretest period (months t_{-64} to t_{-5}) were used to estimate the market model parameters due to insufficient time-series return data following the posttest period.

[7] The questionnaire requested the city finance director to provide the date the annual report was mailed according to records. If no records were available, we requested that an estimated mailing date be provided. Only 39.6 percent of the responses indicated that the mailing date was obtained from municipal records. To determine if results might differ depending on whether the mailing date was based on actual records, we conducted all tests using both the full sample and the subsample based on known mailing date. The results did not differ significantly.

TABLE 1

DISTRIBUTION OF ANNUAL FINANCIAL REPORT RELEASE MONTHS AND LAGS BETWEEN REPORT RELEASE MONTHS AND FISCAL YEAR-ENDS

Panel A. Frequency of Annual Financial Report Releases by Month and Year:

Month	*1982*	*1983*	*1984*	*1985*	*1986*	*1987*	*Total*
January	—[1]	13	17	17	21	17	85
February	—	13	13	16	13	13	68
March	—	7	9	8	9	9	42
April	—	15	10	11	12	11	59
May	—	8	8	8	9	—[1]	33
June	—	12	11	10	7	—	40
July	—	7	11	10	11	—	39
August	1	5	2	6	7	—	21
September	9	11	10	11	10	—	51
October	13	13	12	15	16	—	69
November	20	18	17	10	12	—	77
December	20	20	24	26	28	—	118
Totals	63	142	144	148	155	50	702

Panel B. Lags Between Fiscal Year-Ends and Annual Report Mailing Months:

Lag in Months	*Frequency*	*Percent*	*Cumulative Frequency*	*Cumulative Percent*
1	4	0.6	4	0.6
2	17	2.4	21	3.0
3	29	4.1	50	7.1
4	129	18.4	179	25.5
5	155	22.1	334	47.6
6	180	25.6	514	73.2
7	112	16.0	626	89.2
8	30	4.3	656	93.5
9	23	3.3	679	96.8
10	11	1.6	690	98.4
11	12	1.7	702	100.1[2]

[1] Report release months for January–July 1982 were not included due to restrictions on the fiscal year-ends included (1982–1986) and availability of time-series bond price data. In 1982, the first release month was August since no fiscal year-ends earlier than February 1982 were included in the sample. No report release months after April 1987 were included due to lack of time-series bond data after September 1987 and the need to have four months of returns following the report release month.

[2] The cumulative percentage is larger than 100 percent due to rounding error.

marketing of a new bond issue as part of the bond prospectus.

It is critical to our research design that the probability of information release be lower in the "comparison" periods than in the "test" periods. Given the absence of disclosure of individual city financial data in national media and lack of interim reporting, we generally expected low likelihood of any systematic information release during any of the six-month comparison periods selected. Two possible contaminating events are new bond issues and rating announcements. These two events are highly correlated, however, since most rating reviews occur preceding issuance of bonds. There is a possibility that new issues or rating announcements may tend to cluster in particular months relative to the report release month and, thus, produce a market reaction that might erroneously be attributed to release of the annual report.

To examine this possibility, we calculated the relative timing between report release months and new issues. We identified 79 cases in which the specific timing of new issues relative to the report release months was known. Of these, 68.4 percent of the new issues occurred during the six months preceding the report release month compared with only 31.6 percent during the six months following, but no pattern for particular months was detected. If a new bond issue is a confounding event, the effect of the observed clustering would be to increase the average variability of the three-month preannouncement comparison interval. This would make the relative variability tests more conservative since information leakage would occur for the new issues. Since 69.3 percent of the cities responding to the questionnaire indicated that they did not provide preliminary unaudited information to the bond market, the relatively greater frequency of issues preceding the report release month should not be a confounding factor. Also, to see whether alternative events might be confounding, all tests were conducted on the full sample and a reduced sample for which there were no new issues or rating announcements during either the test months or comparison months. In addition, even more stringent tests were conducted in which any city that had a known bond issue or rating announcement during the sample period was omitted. The results did not differ significantly between the full and the reduced samples. Accordingly, we conclude that new issues are not confounding the main tests. Finally, since the possibility of information leakage at fiscal year-end could not be ruled out, t_0 was defined alternatively as the last month of the fiscal year. Thus, all tests are conducted with test month zero defined alternatively as the report release month and as the last month of the fiscal year.

Residual returns (u_{it}) for each of the test and comparison months were computed via the market model with the security i holding period return for month t based on the natural log of the end of month prices, the monthly coupon interest earned during month t [Ingram, 1985], and the market index proxy.

Absolute Residuals Approach

For each of the nine months surrounding and including the announcement month, absolute residual returns were computed for all cities. A comparison period approach similar to that used by Ohlson and Penman [1985], May [1971], Chambers and Penman [1984], and Atiase [1985] was used to compare for each bond i the absolute residual return for each month in the test period (t_{-1} to t_{+1}) to the absolute residual return for each of the six comparison periods (the three-month pretest interval and the three-month posttest interval). For example, the absolute residual return for each of the 702 report release months (month t_0) was compared with the corresponding six comparison months for a total of 4,212 comparisons. This procedure was repeated for months t_{-1} and t_{+1} to control for the possibility of some measurement error with respect to timing of the report release month. If market prices are affected by the release of the annual report and if there is little or no early release of information, then the return variation in the test periods should be greater than that of the comparison periods. We had no *a priori* reason to believe that the return variation would be higher for months t_{-1} and t_{+1}; these months' return variabilities were compared with those of the comparison months only to test for the possibility of error in measuring the report release month.

The null hypothesis, absent any information effect, is that the probability of test month absolute returns being greater than comparison month absolute returns is 0.5. That is:

$$P\{|u_t| > |u_c|\} = 0.5,$$

where $|u_t|$ is the absolute abnormal return for a test month and $|u_c|$ is the absolute abnormal return for a comparison month.

If new information is associated with price revisions, then the proportion of the test months' absolute returns that exceed those of the comparison months should be significantly greater than 0.5. The normal approximation to the binomial was used to conduct this test:

$$z = (|\mathit{actual\,frequency} - \mathit{expected\,frequency}|) / (.25n)^{.5}$$

where n is the number of comparisons being made and .25 is the appropriate multiplier when the probability of either outcome is 0.5.

As Ohlson and Penman [1985] explain, this test is conservative and relies on few assumptions.[8] Further, correlation between the test month absolute abnormal returns and those of the comparison months is not important since the binomial proportion test is identical to the chi-square statistic used in the sign test for paired samples given that the likelihood of ties in these comparisons is small.

Standardized Squared Residuals Metric

An alternative measure of relative price variability based on standardized squared residual returns following Patell [1976] was also utilized. This statistic compares each month's squared residual return to the average residual variability over the estimation period (60 months in this case). Consequently, the z-statistic for each of the months t_{-4} to t_{+4} tests the null hypothesis that the standardized squared residuals are equal to one in the absence of new information. Since the 60-month estimation period includes several test and comparison periods, we expect the z-statistic for any particular comparison period to be negative and those of the test months (t_{-1} to t_{+1}) to be positive. As explained earlier, the main positive measure is expected in month t_0 since the month before and the month following are examined only to test the possibility of measurement error in determining the true report release month. The standardized squared residual, following Patell [1976], was defined as:

$$U_{it} = \frac{u_{it}^2}{C_{it}s_i^2} \times \frac{T_{i-4}}{T_{i-2}}$$

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[8] We also examined the *magnitude* of absolute abnormal returns for the test month relative to the mean magnitude for all six comparison months. Standard t-tests of the null hypothesis that the magnitude ratios equalled one appeared to yield biased results. Serial correlation in the portfolio variability across the six comparison months resulted in systematically lower variance in those months than in the announcement month. As a result, the tests were biased towards rejection of the null hypothesis. Indeed, randomly generated announcement months consistently produced magnitude ratios significantly greater than one. To avoid the apparent bias in this procedure, the more conservative binomial proportion test described by Ohlson and Penman [1985] was used. Our findings with respect to the magnitude comparisons may have implications for previous studies such as Chambers and Penman [1984] and Atiase [1985] that compared "announcement" period variability measures to those of a comparison portfolio using "non-announcement" periods.

where

$$C_{it}=1+1/T+\frac{(R_{mt}-R_m)^2}{\sum_{t=1}^{T}(R_{mt}-R_m)^2}$$

reflects estimation outside the estimation period, and s_i^2 is the residual mean square for the estimation period, $T=60$, the number of months in the estimation period, t=particular months in the nine-month "window" period, $t=-4,\ldots,+4$, and R_m is the mean of R_{mt} for the base period. U_{it} has an expected value of 1 and variance$=2(T-3)/(T-6)$. A z-statistic to test the null hypothesis that U_{it} equals 1 is given by Patell [1976] as:

$$z_t=\frac{\sum_{i=1}^{N}(U_{it}-1)}{\left[\sum_{i=1}^{N}\text{Var}\,(U_{it})\right]^{.5}}$$

For our tests, the first stage ordinary least squares regression errors are assumed to be randomly and normally distributed with zero mean and constant variance. Further, the tests impose a restriction of zero cross-sectional correlation of error terms, i.e., the error terms for each bond should be uncorrelated with those of all other bonds or else aggregation bias may exist in cross-sectional analysis [Zellner, 1962]. Durbin-Watson tests consistently supported the assumption of no autocorrelation. Given the distribution of announcement months in calendar time, the use of multiple year data, and the use of monthly rather than daily returns, the likelihood of significant aggregation bias due to cross-sectional correlation of the disturbance matrices should be low. This is particularly true for the conservative binomial proportion tests which simply examine the sign of the difference between announcement and non-announcement absolute abnormal returns.

The error terms in the market model regressions exhibited substantial heteroscedasticity. To alleviate this problem, weighted least squares regression was used to estimate the market model parameters. In addition, standardization of the prediction errors mitigates the effects of heteroscedasticity. Finally, Schneeweis [1977] and Weinstein [1981] provide evidence that betas are nonstationary functions of bond duration.[9] To control for this possibility, both the absolute residual return tests and the squared standardized residual tests described previously were conducted using residuals adjusted for the effects of coupon and maturity. Specifically, the market model residuals for each month in the range t_{-4} to t_{+4} were regressed on coupon and months-to-maturity and the resulting "adjusted" residuals were used for the relative variability tests. Since the results were essentially the same using the unadjusted market model residuals, only the unadjusted residual results are reported.

EMPIRICAL RESULTS

Descriptive price variability measures, the mean and median absolute residuals, are provided in Table 2 with t_0 defined both as the annual report release month and as the last month of the fiscal year. Analysis of Table 2 reveals no discernible

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[9] Duration is a positive function of maturity and a negative function of the coupon rate. For risky bonds, duration is affected by default risk. According to Schneeweis [1977, p. 47], lower rated bonds will have less duration due to the higher yield (e.g., risk premium) effect. Weinstein [1981], on the other hand, suggests that default risk may cause expected cash flows to be less than promised, or else the cash flows may be expected to occur later in time, thus increasing duration. Therefore, the effect of default risk on duration is difficult to predict. This probably explains why default risk measures have generally been only weakly associated with systematic risk.

TABLE 2

DESCRIPTIVE STATISTICS FOR ABSOLUTE RESIDUAL MEASURES FOR THE REPORT RELEASE MONTH AND FISCAL YEAR-END

		t_0=Month of Annual Report Release		*t_0=Last month of Fiscal Year*	
Month		*Mean Absolute Residual**	*Median Absolute Residual*	*Mean Absolute Residual**	*Median Absolute Residual*
t_{-4}	Comparison Periods	0.0077	0.0047	0.0087	0.0059
t_{-3}		0.0073	0.0048	0.0081	0.0051
t_{-2}		0.0065	0.0048	0.0087	0.0056
t_{-1}	Test Periods	0.0074	0.0052	0.0083	0.0057
t_0		0.0075	0.0052	0.0067	0.0044
t_{+1}		0.0069	0.0049	0.0083	0.0050
t_{+2}	Comparison Periods	0.0073	0.0051	0.0070	0.0048
t_{+3}		0.0072	0.0046	0.0068	0.0042
t_{+4}		0.0078	0.0054	0.0080	0.0056

* Mean absolute residual is defined as

$$(1/N)\sum_{i=1}^{N}|(U_{it})|$$

where U_{it} is the market model residual return for bond i in month t.

pattern that would suggest information during the three-month "test" interval relative to the two comparison intervals. In general, the measures centered on the month of the fiscal year-end exhibit greater variability and higher period-to-period volatility than those centered on the report release month. However, there is no pattern that suggests greater variability during the test periods than during the comparison periods.

Binomial Proportion Tests

Table 3 provides the results of the binomial proportion tests based on the proportion of cases in which the absolute residuals of the test periods ($|U_t|$) are greater than those of the comparison periods ($|U_c|$). Each cell gives the observed proportion and the associated z-statistic. Proportions below the expected level of .500 result in negative z-statistics.

The first three columns of Table 3 provide the proportion measures and test statistics for the test months (defined as the report release month and one month before and after the release month). The absolute residuals for each of the test months are compared with those of each of the comparison months and with all six comparison months to obtain the overall proportions shown at the bottom of each column. As was the case for the descriptive measures in Table 2, there is no indication of market reaction to the release of the annual report. None of the individual month comparisons are significant nor is the overall comparison significant.

Results for the test month defined as the last month of the fiscal year are provided in the last three columns of Table 3. For test month t_0, the last month of the fiscal year, absolute residual returns exhibit significantly lower variability than

TABLE 3

ABSOLUTE RETURN COMPARISONS
TEST MONTHS VS. COMPARISON MONTHS
BASED ON ANNUAL REPORT RELEASE MONTH AND FISCAL YEAR-END

Proportion of test month absolute returns that were larger than the comparison months' returns
($Pr\{|U_t| > |U_c|\}$) (z-statistics in parentheses)
(Expected proportion is 0.5)

Comparison Month	t_0=Annual Report Release Month			t_0=Last Month of Fiscal Year		
	Month t_{-1}	Month t_0	Month t_{+1}	Month t_{-1}	Month t_0	Month t_{+1}
t_{-4}	0.499 (−0.04)	0.503 (0.11)	0.489 (−0.57)	0.499 (−0.04)	0.429 (−3.74)[b]	0.460 (−2.07)
t_{-3}	0.494 (−0.26)	0.501 (0.04)	0.500 (0.00)	0.511 (0.57)	0.433 (−3.51)	0.476 (−1.25)
t_{-2}	0.507 (0.34)	0.521 (1.09)	0.510 (0.49)	0.477 (−1.17)	0.380 (−6.30)	0.484 (−0.79)
t_{+2}	0.490 (−0.49)	0.501 (0.04)	0.500 (0.00)	0.575 (3.96)*	0.456 (−2.25)	0.536 (1.09)
t_{+3}	0.510 (0.49)	0.509 (0.42)	0.506 (0.26)	0.598 (5.17)*	0.479 (−1.09)	0.556 (3.66)*
t_{+4}	0.483 (−0.87)	0.479 (−1.09)	0.466 (−1.77)	0.511 (0.57)	0.450 (−2.60)	0.491 (−0.42)
Overall Proportion[a]	0.497	0.502	0.495	0.529	0.438	0.500
Overall z-statistic	−0.35	0.29	0.63	3.71*	−8.06	0.00

[a] The overall percentage is based on comparing each test month to all six comparison months. Under the null hypothesis of equal variability, the expected proportion is 0.5. The z-statistic is based on the normal approximation to the binomial proportion for large samples.

[b] Negative z-statistics indicate that the proportion of test month absolute returns that were larger than those of a particular comparison month is less than .5, as expected under the null hypothesis.

* Significant at the .001 level (one-tailed test).

the comparison months. For the month preceding the month of the fiscal year-end (t_{-1}), the absolute residuals exceed those of comparison months t_{+2} and t_{+3} at the .0001 level. The overall comparison is also significant at the same level. Similarly, the absolute residual for month t_{+1} is significantly greater than that for comparison month t_{+3}, but not for any of the other comparison months. While these results appear to support information prior to and following the last month of the fiscal year, they call into question why the absolute residuals for test months t_{-1} and t_{+1} are not greater than those of the preannouncement comparison periods. We elaborate below.

Squared Standardized Residuals Test

Table 4 provides the tests of squared standardized residuals based on the null hypothesis that the mean value will be

TABLE 4

TESTS OF SQUARED STANDARDIZED RESIDUALS WITH ANNOUNCEMENT MONTH DEFINED ALTERNATIVELY AS THE ANNUAL REPORT RELEASE MONTH AND THE FISCAL YEAR-END

($n = 702$)

	Report Release Month		*Fiscal Year-End*	
Month	*Mean*	*z-statistic*[a]	*Mean*	*z-statistic*[a]
−4	0.904	−1.75	1.274	4.99***
−3	0.775	−4.10	1.093	1.69*
−2	0.610	−7.11	1.145	2.64*
−1	0.749	−4.57	1.125	2.28**
0	0.861	−2.53	0.799	−3.65
+1	0.724	−5.02	1.023	0.42
+2	0.736	−4.81	0.702	−5.43
+3	0.828	−3.14	0.796	−3.71
+4	0.973	−0.50	0.969	−0.56

[a] The *z*-statistic tests the null hypothesis that the mean squared standardized residual equals one. Positive values of *z* correspond to means greater than one and negative values to means less than one. Thus, a significant negative value indicates that the level of variability is significantly lower than that of the 60-month estimation period. Since our tests are one-sided positive, we do not indicate the levels of significance for negative signs.

* Significant at the .05 level (one-tailed test).

** Significant at the .01 level (one-tailed test).

*** Significant at the .001 level (one-tailed test).

equal to one absent information. In effect, this test examines whether the standardized residuals for each month (comparison or test) differ from the benchmark variability calculated over the 60-month estimation period. Mean values significantly greater than one (positive *z*-statistics) indicate relatively greater variability; mean values lower than one (negative *z*-statistics) indicate relatively lower variability.

As in Tables 2 and 3, the results for the test month defined as the report release month reflect no increased variability. Indeed, as the significant negative *z*-statistics show, the test and comparison months all exhibit a lower level of residual variability than the average level prevailing over the 60-month estimation period. Given that the 60-month estimation interval may contain randomly distributed significant events such as new bond issues and rating change announcements (these events are discussed in the next section), weak market reaction to the release of the annual report may fail to produce a positive *z*-statistic. However, as stated previously, similar results were obtained when all tests were rerun with known bond issues and rating announcements removed.[10]

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[10] Separate tests were also run individually for each of the years 1982–1987 with the event month defined as the report release month. For years 1984–1987, the results were similar to those shown in Table 4 in that all *z*-statistics were negative and were significant (.05 level) in most comparison and test months (although the hypotheses tested were one-tail positive). For years 1982–1983, however, most comparison and test months exhibited positive *z*-statistics, with significant (.05 level) values observed in months t_0, t_{+3}, and t_{+4} for 1982 and t_{-4}, t_{-3}, and t_0 for 1983. Months t_{-4} to t_{-1} for 1982 were insignificantly negative and months t_{+1}, t_{+3}, and t_{+4} for year 1983 were insignificantly positive. Month t_{+2} for 1982 was significantly negative ($z = -3.135$). Given that the positive values observed for 1982 and 1983 occurred more frequently in the comparison months than in the test months, the results do not suggest market reaction to the report release. Rather, the higher average variability observed

The results for the test month t_0 defined alternatively as the last month of the fiscal year indicate relatively high variability in all three pretest period comparison months (months t_{-4} to t_{-2}) and the month prior to the month of the fiscal year-end (month t_{-1}). Analysis indicates that these results are consistent with those reported in Table 3 using the binomial proportion test in which the magnitude of absolute residual differences are ignored. As Table 4 shows, the relatively high variability for the three months in the pretest comparison interval (t_{-4} to t_{-2}) make it unlikely that more than 50 percent of the test month absolute returns would exceed those of the pretest comparison months, as expected under the null hypothesis. On the other hand, the very low relative variability of months t_{+2} and t_{+3} in the posttest comparison interval make it more likely that more than 50 percent of the test month absolute returns would exceed those of months t_{+2} and t_{+3}. These assumptions are more likely for test month t_{-1} than for any of the other test months since it exhibits relatively high variability. However, since month t_0 has very low variability, it is unlikely that its variability would, on average, exceed that of any of the comparison months. These expectations are supported by Table 3, thus indicating that the results of the two approaches (binomial proportion vs. squared standardized residuals) are consistent.

Since external interim financial reporting is not practiced by municipalities, we have no knowledge of any specific events that would account for the increased variability for the four months preceding the fiscal year-end.[11] As the results discussed in the next section show, however, these results are relatively weak compared with the strong market reaction to other events such as new bond issues and bond rating announcements.

Validation of Testing Procedures

Given the negative results for the main tests centered on the report release month and the unexpectedly high pre-fiscal year-end variability, questions arose about the informational efficiency of the bond return data used in our study and the statistical power of the testing procedures. In other words, we questioned whether the returns data incorporate the effects of new entity-specific information on a contemporaneous basis.

To examine these questions, we redefined the event to be one having a high probability of affecting seasoned bond prices. Two such events are new issues of general obligation bonds and announcements of rating changes or rating confirmations by Moody's Investor's Service.

The professional literature on municipal bonds (e.g., Lamb and Rappaport [1987] and Public Securities Association [1981]) describes intensive market activity and information exchange (such as information search, canvassing of potential buyers, formation of bidding syndicates, and coordination among dealers, brokers, and institutional investors) during the marketing of a new issue. Given the dearth of entity-specific information in major media sources (especially for smaller cities), public disclosure of the selling price of newly issued bonds provides an opportunity for holders of seasoned bonds to adjust secondary market prices to bring their prices in line with those in the primary market. In addition,

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for 1982 and 1983, followed by lower variability for 1984–1987 is consistent with the high price volatility of the bond markets in the early 1980s.

[11] One interpretation for the pre-fiscal year-end significant results is information leakage relating to formation and adoption of the annual budget, which typically occurs in the few months preceding a new fiscal year. We are indebted to one of the reviewers for pointing out this possible explanation.

the offering statement (prospectus) for a new issue usually contains a large amount of financial and socioeconomic data about the issuer. Thus, if the market has not adjusted contemporaneously to financial disclosure at the time the annual report is released (as our results suggest), then financial and other information disclosure in connection with the new issue may further affect price adjustments in seasoned bonds.

Since the event (test) month in this alternative test was defined as the month when the bonds were actually sold to an underwriting syndicate, the official (offering) statement could be circulated in some instances the month prior to the month of sale. Thus, there is some reason to expect seasoned bond prices to adjust the month prior to actual sale. Data on the timing of release of the official statement relative to the month of sale were not available. However, the bond literature (e.g., Lamb and Rappaport [1987] and Public Securities Association [1981]) indicates that competitive bid solicitations and official statements are often received only a week before the actual day of sale.

Prior studies (e.g., Ingram et al. [1983]) suggest that announcements of bond rating changes also strongly influence bond prices and the relation between bond ratings and bond prices or yields has been consistently supported by municipal finance research [Ingram et al., 1987]. Even rating confirmation notices may have information if the market had previously adjusted prices in anticipation of a possible upgrade or downgrade, and the rating agency decides against changing the rating. That is, investors may react to such announcements in the belief that rating agencies possess superior knowledge about the issuer's default risk. Whether the market reacts to rating changes or anticipates them remains an unsettled issue in both the corporate and municipal bond literature. Thus, we include all types of rating announcements (upgrades, downgrades, and confirmations) in the tests which follow.

Many rating announcements occur in the same month as new issues of bonds. In our samples of 410 rating announcements and 368 new issues occurring over the period 1982–1985, there were 256 cases in which the rating announcements corresponded to specific new issues. Of these 256, 170 or 66.4 percent of the rating announcements occurred during the same month as new issues. Another 47 rating announcements (18.3 percent) occurred during the three months preceding the new issues. The remaining 15.3 percent of the rating announcements were well distributed over the six months preceding and following the new issues. Although these events (new issues and rating announcements) are highly overlapping, either or both are expected to produce a strong effect on secondary municipal bond prices.[12]

To validate our data and statistical procedures, the same data, same procedures, and same design scheme are used to test the market price reaction to announcements defined alternatively as new issues and rating announcements. Data on new issues were obtained from the *Weekly Bond Buyer* published by The Bond Buyer, Inc. and data on rating announcements were obtained from *Moody's Bond Survey* published weekly

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[12] These data were collected for a different study and were collected for all 377 cities for which we have time-series bond price data rather than just the cities examined in this study. As such, these samples contain all known new issues and rating announcements of the cities included in our study as well as the other cities in our bond price data base. Thus, though the new issue and rating announcement samples overlap the sample used in the main analysis, they represent mainly different cities. Nevertheless, they serve the intended purpose which is to provide an alternative test of the efficiency of our price data and power of our statistical procedures.

TABLE 5

TESTS OF SQUARED STANDARDIZED RESIDUALS WITH ANNOUNCEMENT MONTH DEFINED ALTERNATIVELY AS THE MONTH OF NEW BOND ISSUES OR BOND RATING ANNOUNCEMENTS

	t_0=*New Bond Issues* (n=368)		t_0=*Bond Rating Announcements* (n=410)	
Month	*Mean*	*z-statistic*[a]	*Mean*	*z-statistic*[a]
−4	1.417	5.50***	0.901	−1.38
−3	1.172	2.27*	0.925	−1.05
−2	1.216	2.85**	0.870	−1.81
−1	1.073	0.96	0.740	−3.62
0	5.004	52.65***	4.065	42.71***
+1	1.662	8.73***	1.097	1.36
+2	1.131	1.73*	0.925	−1.04
+3	1.184	2.43**	0.937	−0.87
+4	0.774	−2.98	0.955	−0.62

[a] The z-statistic tests the null hypothesis that the mean squared standardized residual equals one. Positive values of z correspond to means greater than one and negative values to means less than one. Thus, a significant negative value indicates that the level of variability is significantly lower than that of the 60-month estimation period. Since our tests are one-sided positive, we do not indicate the levels of significance for negative signs.

* Significant at the .05 level (one-tailed test).
** Significant at the .01 level (one-tailed test).
*** Significant at the .001 level (one-tailed test).

by Moody's Investor's Service. The 410 rating announcements consisted of 16 upgrades, 42 downgrades, and 352 reviewed and confirmed announcements.

Results of tests on the squared standardized residuals with announcement month defined alternatively as new issues and rating announcement dates are provided in Table 5. The tests for both types of announcements reflect a large increase in variability in the announcement month.[13] The results are unambiguous for rating announcements since no other months exhibited significantly increased variability. Increased variability persists at a fairly high level for the month following new bond issues, possibly reflecting continuing market activity by the winning underwriter syndicate in attempting to resell the issue in the secondary market. Since the actual sale date for each new bond issue was known with reasonable certainty, timing error appears unlikely.

In addition, significant variability is observed during several of the comparison months. We speculate that these results indicate price adjustment to such phenomena as local bond referenda, initial municipal contacts with rating agencies and underwriters, and prebid advertising. Postannouncement adjustments may reflect continued efforts to market the new issue, particularly since the winning underwriters often sell portions of new issues to dealer/brokers who then attempt to sell the bonds to investors. The results may also reflect the sensitivity of the test statistics given that relatively small departures from the expected value of 1.0 produce statistically significant results because of the large sample size. Finally, the results may be

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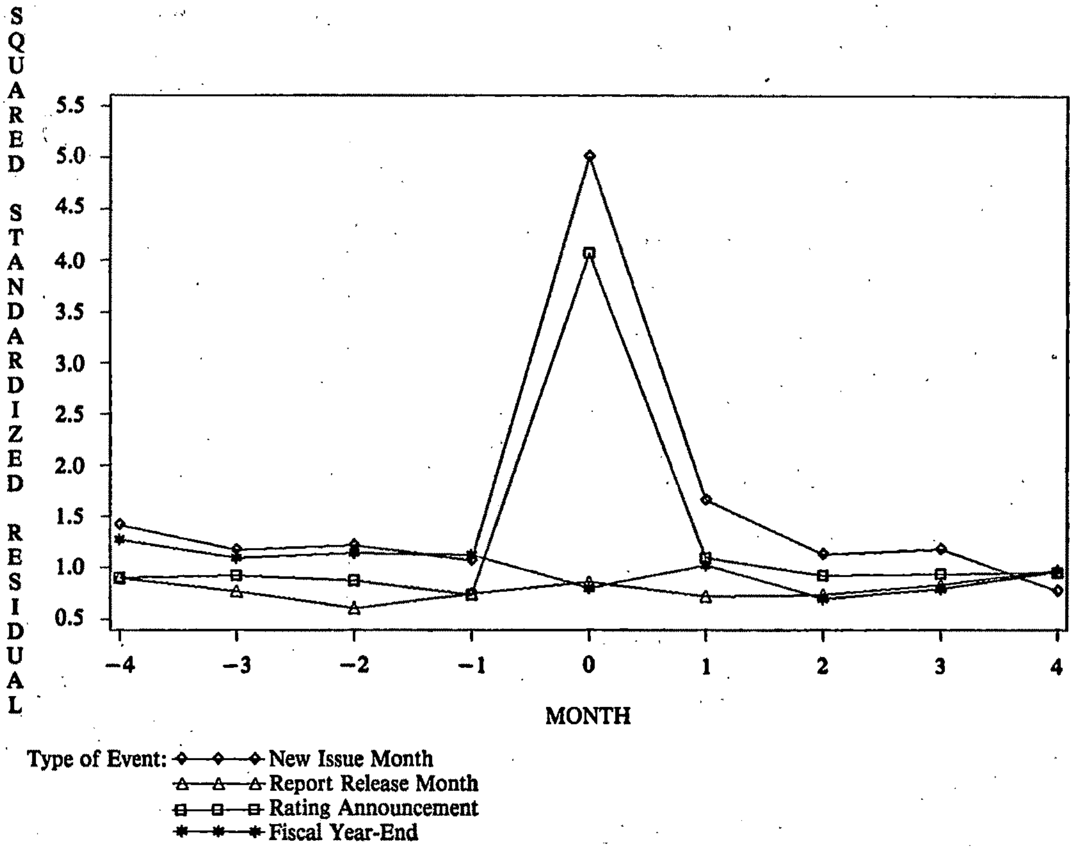
[13] Similarly strong results for month t_0 were obtained using the binomial proportion tests, which are omitted for the sake of brevity.

FIGURE 1
PLOTS OF SQUARED STANDARDIZED RESIDUALS BASED ON FOUR ALTERNATIVE EVENTS



sensitive to the inherent volatility of municipal bond prices.

To place the strong results for new issues and rating announcements in perspective, the mean squared standardized residuals have been plotted for all nine months centered on the announcement month. Separate plots are provided for the report release month, the month of the fiscal year-end, new issue month, and rating announcement month. These plots are shown in Figure 1 and clearly show that market reaction to the release of the annual financial report is much smaller than the strong effect produced by new issues and rating announcements. This suggests that the bond market processes new information at these times to a much larger extent than at fiscal year-end or when the annual report is received.

Additional Analyses

It is possible that the market reacts to the financial information in the annual report in a differential manner depending on the characteristics of particular cities. Two plausible partitions are size of the city and bond rating. Similar corporate research [Atiase, 1985] provides evidence that market reaction to information disclosures is stronger for small firms than for large firms. Apparently, disclosures by smaller firms contain more "surprises" since fewer alternative sources of information are available for smaller firms. In a similar vein, Benson et al. [1986a, 1986b] found that interest costs on new bond issues were more strongly associated with municipal accounting numbers for issues rated medium grade (A or A1) relative to those rated high grade (Aa and Aaa). This would suggest that information search and use is inversely related to credit quality.

To test whether size of the city or bond rating class might affect market use of financial information, all tests were performed on partitions of the sample based on population and bond rating. The results were not materially different from those reported. Accordingly, the evidence does not suggest that the results were dependent on specific attributes of the sample.

SUMMARY AND CONCLUSIONS

Previous research in the corporate area has provided strong evidence of increased variability of security prices contemporaneous with the release of new information. Ohlson [1979] provides the theoretical basis for such an association as a measure of information content. This study is a first attempt to determine whether municipal bond prices also exhibit increased variability contemporaneous with the release of annual report information. Two alternative dates were selected for analysis: the annual financial report release month and the last month of the fiscal year-end. We were unable to identify any significant market reaction to the release of annual reports.

These results are consistent with the conclusion that local government annual reports do not convey significant information to bond investors at the time of the release of the reports. This study does not rule out the possibility that the information contained in the annual report may be useful to investors at other points in time—e.g., in assessing the validity of bond rating changes or in decisions to purchase new issues. However, the results do support the conclusion that bond investors do not monitor accounting reports closely in assessing the market value of seasoned bond issues.

These results may suggest that the relative thinness of the municipal bond market makes it difficult for individual investors to capture the benefits of monitoring accounting information for local governments. This problem is likely to be confounded by the lack of unambiguous measures of government performance and by the complexity of the information contained in the accounting reports of these entities. A high cost to benefit ratio would explain why municipal bond investors rely on rating agencies to assess default risk and respond markedly to rating announcements.

Any conclusions must be tempered by certain limitations of the study. The bond price data used in the study are institutional price estimates that may not be especially sensitive to minor variations in the trade prices of individual bonds. Accordingly, our tests may not be sufficiently sensitive to detect relatively small market reactions. We can only conclude that large reactions do not appear to exist.

Currently available data do not permit more sensitive analysis of bond market responses or of the timing of the release of the annual reports. Both of these problems reduce the power of the tests used in the study and bias the results toward non-rejection of the null hypothesis.

The results of this study are important because they have implications for the identification of the users of accounting information. The GASB has attempted to identify such users as a basis for specifying the nature of information that should be provided to primary users of this information (see GASB [1987]). However, these results suggest that investors in municipal bonds may not react directly to accounting information. Instead, it may be that intermediaries, such as rating agencies, are the primary users of the information so far as it impacts on investment decisions.

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Ownership Structure and Inventory Method Choice

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ABSTRACT: This paper examines the relation between inventory method choice and both managerial ownership and outside ownership concentration. It is hypothesized that a conflict of interest between managers and shareholders can arise over inventory method choice, and that ownership structure, in part, determines how potential conflicts of interest are resolved. The evidence is consistent with this hypothesis as the inventory choice appears to be related to both managerial ownership and outside ownership concentration. When managerial ownership is low, the likelihood of LIFO is negatively related to managerial ownership. However, when managerial ownership is high, the likelihood of LIFO is positively related to managerial ownership. Higher outside ownership concentration appears to increase the likelihood of LIFO, *ceteris paribus*.

THE positive theory of accounting provides hypotheses that relate financial accounting method choices to a number of firm and industry characteristics [Holthausen and Leftwich, 1983]. Several studies relate accounting method choices to a firm's ownership concentration, hypothesizing that when ownership is diffuse, managers exercise considerable discretion over the choice of accounting methods (e.g., Smith [1976], Salamon and Smith [1979], Dhaliwal et al. [1982], and Amihud et al. [1983]). This paper examines the theoretical arguments that predict a relation between ownership structure and the inventory method choice and empirically tests the validity of the hypothesized relations.

An association between ownership structure and financial accounting choices is based on two premises: (1) a potential conflict of interest between managers and shareholders arises over accounting method choices, and (2) a firm's ownership structure in part determines the resolution of potential incentive conflicts.

The inventory method choice provides a good example of how managers and shareholders can have conflicting interests with respect to financial accounting. Inventory method choice differs from other accounting method choices because of the IRS LIFO conformity rule: if a firm uses LIFO for tax purposes it must also do so for financial reporting purposes [Internal Revenue Code, Sec. 472-2(e)]. If LIFO is the tax minimizing method, then shareholders are likely to

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prefer that LIFO be used. However, if compensation committees do not adjust for the inventory method chosen, then a positive correlation will likely exist between managerial compensation and reported income. Consequently, managers may have an incentive to choose the income increasing inventory method, FIFO, and a conflict of interest can arise over the inventory method choice if LIFO is the tax minimizing method.

Several hypotheses relate the resolution of incentive problems to a firm's ownership structure. First, as the concentration of outside ownership increases, these outsiders have greater incentive to monitor managers. Consequently, managerial discretion is likely to decrease as outside ownership concentration increases. Second, higher levels of managerial ownership align the interests of managers and other shareholders [Jensen and Meckling, 1976]. Third, a high level of managerial ownership makes it difficult for outsiders to discipline managers. Consequently, managerial discretion increases as managerial ownership increases [Morck et al., 1988]. An alternative to these three hypotheses is that the agency problem between managers and shareholders is not related to ownership structure because of the substitutability of alternative mechanisms for motivating managers [Brickley and James, 1987].

This paper examines the relation between a firm's ownership structure and its inventory method choice. Specifically, the relation between the inventory method choice and both managerial ownership and outside ownership concentration are examined. The evidence supports the joint hypothesis that there is a conflict of interest between managers and shareholders over the inventory method, and that ownership structure affects the resolution of this incentive conflict.

The empirical relation between ownership structure and the accounting methods chosen to report depreciation and investment tax credits are also examined. Since a conflict of interest between managers and shareholders is not likely to exist over these two accounting method choices, the theory does not predict that ownership structure is related to these choices. The evidence supports the theory, as no relation between ownership structure and the depreciation and investment tax credit choices is found.

The paper is organized as follows. In the next section, the hypotheses that relate ownership structure to accounting choices are discussed. In Section II, the empirical methods and results are presented. A short summary concludes the paper.

I. THEORETICAL BACKGROUND

In a well-functioning capital market, higher tax liabilities imply a lower share price, *ceteris paribus*. Thus, it is reasonable to assume that shareholders prefer that managers choose the inventory method that minimizes taxable income.[1] However, if management compensation is positively related to reported income, then managers have an incentive to choose an inventory method that maximizes reported income. Because of the IRS conformity rule, the minimization of taxable income and the maximization of reported income cannot both be obtained when LIFO is the tax minimizing method. Thus, a potential conflict of interest between managers and shareholders arises when LIFO is the tax minimizing method.[2]

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[1] Tax minimization is not necessarily the objective of shareholders [Gilson et al., 1986].

[2] When FIFO is the tax minimizing strategy, a conflict of interest is not likely to arise because FIFO can be chosen for tax purposes and LIFO can be chosen for reporting purposes.

Managerial compensation is likely to be positively correlated with reported income for several reasons. For example, managerial talent is likely to be partially assessed on the basis of accounting earnings. In addition, most managerial bonus plans are tied to reported income [Healy, 1985].[3]

The existence of an income-based bonus plan, however, is not sufficient evidence to conclude that managerial compensation will be higher under the income increasing inventory method. In particular, compensation committees can make bonuses contingent on the inventory method used by managers. However, Healy et al. [1987] find no evidence that subsequent to accounting method changes, "reported earnings are transformed to earnings under the original accounting method for computing compensation awards" [p. 32]. Thus, for the purpose of deriving testable implications, this paper assumes that management compensation increases with reported income.

Suppose that LIFO is the tax minimizing method. Then the assumption about management compensation implies that there is a potential conflict of interest between managers and shareholders over the inventory method choice. Numerous papers in accounting, finance, and economics (e.g., Dhaliwal et al. [1982], Morck et al. [1988], and Demsetz and Lehn [1985]) examine the role of ownership structure in resolving potential manager-shareholder conflicts. The present study considers two aspects of ownership: managerial ownership and the concentration of outside ownership. An outside owner is considered to be different from managers in that the former is not likely to be involved in the day-to-day business of the firm.

Managerial ownership can prevent a conflict over the inventory method choice from arising. In particular, managers with an ownership stake in the firm are faced with the following tradeoff: LIFO results in a higher stock price and, therefore, greater value for the manager's shares; FIFO results in higher reported income and, therefore, greater executive compensation. The greater the managerial ownership, the less likely is a conflict of interest over the inventory method choice, because the stock price effect is more likely to dominate the compensation effect.

Even if a conflict of interest exists (because the compensation effect dominates the stock price effect), the manager may not have the discretion to choose FIFO. That is, mechanisms for motivating the manager to act in shareholders' interests may induce the managers to choose LIFO.

There are numerous mechanisms for motivating managers to act in shareholders' interests. In particular, mechanisms that control incentive problems include monitoring, bonding, compensation contracts, the market for corporate control [Manne, 1965], the managerial labor market [Fama, 1980], and competition in the product market [Hart, 1983]. This paper focuses on the role of outside ownership concentration and managerial ownership in resolving manager-shareholder conflicts.

Consider the effects of concentrated outside ownership, holding managerial ownership fixed. For a shareholder with a small ownership claim, there is little incentive to monitor the management of the firm. This shareholder would bear all monitoring costs, but receive only a small fraction (his or her percentage ownership) of the total monitoring benefits. In contrast, for a shareholder with a large ownership interest, the private benefits from monitoring are more likely to outweigh the costs. Thus, shareholder monitoring of managers is likely to be directly related to outside ownership concentration. *Ceteris paribus*, greater monitoring increases the likelihood that managers will choose LIFO when a conflict between managers and shareholders exists.

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[3] Healy [1985] shows that compensation plans are typically structured so that compensation is an increasing function of earnings only if earnings are between a lower bound and an upper bound. As a result, there are conditions under which it is advantageous for managers to defer income for future periods. However, Healy classifies over 84 percent of his sample in the region in which the upper and lower bounds are not binding. Thus, for the majority of firms, the constraints are not likely to be a consideration. On the other hand, Healy finds that the constraints affect accounting choices.

Managerial ownership is also likely to be an important consideration in whether managers have the discretion to choose FIFO. Morck et al. [1988] argue that high levels of managerial ownership may make it extremely costly or impossible for outsiders to discipline managers. Consequently, managerial discretion is likely to increase as managerial ownership increases. Thus, if a conflict over the inventory method exists, the managerial discretion hypothesis predicts that the likelihood of LIFO decreases as managerial ownership increases.

The above discussion can be summarized as follows. Assuming LIFO is the tax minimizing inventory method and management compensation increases with reported income, the likelihood of a conflict of interest between managers and shareholders over the inventory method choice decreases as managerial ownership increases. When there is a conflict of interest, the likelihood of LIFO increases as outside ownership concentration increases and as managerial ownership increases, *ceteris paribus*.

It is difficult to observe whether or not there is a conflict of interest between managers and shareholders over the inventory method choice. Consequently, the above hypotheses cannot be tested directly. The hypotheses can be tested indirectly by relating the choice of inventory method to both managerial ownership and outside ownership concentration. In particular, the following model is examined.

$$\begin{aligned}\text{Prob [LIFO]} = a &+ b_1 MGR + b_2 MGR^2 \\ &+ b_3 OUTCON \\ &+ b_4(OUTCON \times MGR) \\ &+ \text{other control variables,}\end{aligned}$$

where *MGR* is the level of managerial ownership and *OUTCON* is a measure of outside ownership concentration.[4]

As discussed above, there are two effects of managerial ownership. First, higher levels of managerial ownership help to align the incentives of managers and shareholders and, therefore, make LIFO more likely. Second, if a conflict exists, higher managerial ownership increases managerial discretion and, therefore, decreases the likelihood of LIFO. The relation between *MGR* and the inventory method choice depends on how the incentive alignment effect interacts with the discretion effect. Since one effect may dominate over one range of managerial ownership and the other effect over another range, a non-monotonic relation between managerial ownership and the inventory method choice may exist. To accommodate such a possibility, both *MGR* and MGR^2 are used as independent variables. If the discretion effect dominates over the low range of managerial ownership and the incentive alignment effect dominates over the high range, then b_1 would be negative and b_2 would be positive.[5] If the incentive alignment effect (discretion effect) dominates over the entire range of managerial ownership, then both b_1 and b_2 would be positive (negative).

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[4] A problem with testing the hypotheses that ownership structure affects accounting choices is that a firm is not exogenously endowed with an ownership structure. Endogeneity of ownership raises the issue of the proper specification for the empirical tests. The hypotheses presented above state that accounting choices depend on ownership structure. If there were also reason to believe the reverse causality, that is, ownership structure depends on accounting choices, then a simultaneous system would have to be estimated. However, there is no *a priori* reason to hypothesize that ownership structure depends on accounting choices. Thus, the above equation can be estimated by itself (see Kmenta [1986, p. 720]).

Ceteris paribus, higher outside ownership concentration decreases managerial discretion and, therefore, increases the likelihood of LIFO. Consequently, b_3 is expected to be positive.

Managerial ownership can also interact with outside ownership concentration. On one hand, the managerial discretion afforded by high managerial ownership can counteract the disciplining effect of outside ownership concentration. On the other hand, because managerial ownership helps to align the incentives of managers and owners, high managerial ownership can reinforce the disciplining effect of outside ownership concentration. Thus, the sign of b_4 depends on how managerial ownership interacts with outside ownership.

An alternative hypothesis to those presented above is that accounting choices are not related to ownership because of the substitutability of alternative mechanisms for motivating managers. For example, if low outside ownership concentration makes monitoring less effective, then a greater emphasis can be placed on monitoring by directors, or a different corporate governance structure can be used. In the extreme case that the various mechanisms are perfect substitutes, the resolution of incentive problems will not be related to managerial ownership or outside ownership concentration.[6]

II. EMPIRICAL ANALYSIS

Data

The sample consists of companies from the 1980 *Fortune 500* list of industrial firms. Ownership data were obtained from the *Fortune 500 Corporate Data Exchange (CDE) Stock Ownership Directory* for 1980. This directory reports the percentage of common shares owned by any party that holds more than 0.2 percent of the outstanding shares. The CDE data set excludes firms that were acquired in 1980, firms that were wholly or "tightly" owned by one or two companies, and firms that were privately held. Because of these exclusions, ownership data are available for 456 firms.

The shareholders of each firm were classified into one of two categories: outsider or manager. Information about the managers of the firms was obtained from the 1980 *Standard and Poor's Register of Corporations, Directors, and Executives*, Volume 1 which lists the executives and directors of all major corporations in the U.S. A shareholder was classified as a manager if the *Standard and Poor's Directory* indicated that the shareholder had one of the following titles: chairman, chief executive officer, chairman of the executive committee, president, or vice president.[7] The variable *MGR* equals the percentage of shares owned by the managers with the five largest ownership interests. The variable *OUTCON* equals the percentage of shares owned by the outsiders with the five largest ownership interests.[8]

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[5] The reverse case (the incentive alignment effect dominates over the low range and the discretion effect dominates over the high range) is very unlikely to occur because if incentives are aligned at a given level of managerial ownership, incentives must be aligned at all higher levels of managerial ownership.

[6] Brickley and James [1987] find little empirical support for the substitution hypothesis in the banking industry.

[7] A second classification scheme, excluding owners with the title of chairman from the managerial classification, did not significantly affect the results.

[8] Recall that the data set contains information only about shareholders who own more than .2 percent of the

TABLE 1

PRICE CHANGE DATA FOR 304 PRODUCT CATEGORIES FROM 1978 THROUGH 1982

Number of Years in Which Prices Decreased	*Number of Product Categories*	*Percentage*
0	201	66.1
1	52	17.1
2	30	9.9
3	18	5.9
4	3	1.0
5	0	0.0

Source: Producer Price Survey, Bureau of Labor Statistics.

Financial data were obtained from the *Value Line* and COMPUSTAT files, with the *Value Line* classifications used to determine the inventory method chosen by the firm. In order to focus on the extreme cases, firms that used an average-cost inventory method were removed from the sample. One hundred and twelve firms were excluded due to use of an average cost inventory method or incomplete financial statement data. Of the remaining 344 firms, 224 (65 percent) firms used LIFO "as a rule" and 120 (35 percent) firms used FIFO "as a rule."

The hypotheses discussed in the previous section assumed that LIFO was the tax minimizing inventory method. Thus, the firms in the sample need to be classified according to what inventory method was likely to yield the lowest present value of future tax payments. The ideal way to classify firms is to compute expected earnings under both the LIFO and the FIFO methods. A comparison of actual earnings in a given year under LIFO versus FIFO is possible for firms that choose LIFO, because LIFO firms disclose in the footnotes of their annual report information necessary to restate inventories using the FIFO method. Thus, for 224 firms a direct comparison of earnings under LIFO versus FIFO was conducted for the year 1980. For all 224 LIFO firms, the LIFO method was the tax minimizing strategy.

Unfortunately, for firms that choose FIFO a direct comparison between LIFO and FIFO is not possible using published financial statements. However, there are several observable criteria that increase the likelihood that FIFO is the tax minimizing strategy.

The likelihood that FIFO is the tax minimizing strategy increases if prices are declining. Thus, data on the rate of change of prices for 304 product categories over the 1978–1982 period were examined. Table 1 indicates that for 66.1 percent of the categories prices did not decline in any of the five years examined. In only seven percent of the product categories did prices fall in three or more years. Those product categories that had two or more years of decreasing prices are listed in Table 2. The industries most

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firm. For some firms, fewer than five managers and/or nonmanagers owned a sufficient number of shares to be included in the data set. For these firms, the variables *MGR* and *OUTCON* represent the ownership of less than five shareholders. The qualitative results are not altered by reducing the number of parties included in the ownership measures.

TABLE 2

PRODUCT CATEGORIES WITH TWO OR MORE YEARS OF DECLINING PRICES DURING 1978–1982

Product Categories with two years of declining prices:

Livestock
Hogs
Hay, hayseeds
Other farm products
Processed poultry
Fats and oils
Prepared animal feed
Leather
Residual fuels
Woodpulp
Nonferrous metals
Nonferrous scrap
Home electronic equipment
Household flatware
Gypsum products
Cattle
Plant fibers
Oilseeds
Milled rice
Sugar confectionery
Processed eggs
Vegetable cake
Finished cattle hide
Lumber and wood products
Wastepaper
Primary nonferrous metals
Secondary nonferrous metals
Other home electronics
Prepared asphalt
Other miscellaneous

Product Categories with three years of declining prices:

Live poultry
Plant and animal feed
Eggs
Packaged beverage
Grain by-product feed
Cattle hides
Lumber
Plywood
Nonferrous wire
Turkeys
Foreign wool
Hayseeds
Crude vegetable oil
Formula feeds
Fats and oils, inedible
Softwood lumber
Iron and steel scrap
Television receivers

Product Categories with four years of declining prices:

Green coffee, cocoa
Radio receivers
Softwood plywood

likely to have experienced falling prices are the food, electronics, and wood products industries. Relative to other industries, it is likely that FIFO was the tax minimizing method in these three industries. To control for the special circumstances in the food, electronics, and wood products industries, indicator variables for these industries (*FOOD*, *ELECT*, and *WOOD*) are included in the analysis.[9]

The FIFO method also provides a tax advantage not offered by LIFO. The choice of FIFO allows firms to mark down the value of inventory to market values at year end. This advantage makes FIFO the tax minimizing strategy for some firms. Lee and Hsieh [1985] argue that firms in the publishing industry find FIFO advantageous because it allows them to mark down the value of unsold books at the end of each fiscal year. Thus, the tax minimizing inventory method for some publishing firms is likely to be FIFO. Consequently, an indicator variable for the publishing indus-

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[9] Nineteen of the 24 firms in the food industry, 22 of the 36 firms in the electronics industry, and three of the 23 firms in the wood products industry used FIFO.

TABLE 3

CROSS-CLASSIFICATION OF INVENTORY CHOICE AND INCOME BASED BONUS PLAN

	Income Based Bonus Plan		
	No	*Yes*	*Row Totals*
LIFO	25 (60%)	199 (66%)	224 (65%)
FIFO	17 (40%)	103 (34%)	120 (35%)
Column Totals	42 (12%)	302 (88%)	344 (100%)

Entries are: Number (Column Percentage).
$\chi^2_{(1)}=0.66$
p-level $=.42$

try (*PUB*) is included in the analysis.[10]

The theoretical discussion also assumed that managerial compensation is positively related to reported income. Although it is impossible to verify whether this assumption is correct, data on management contracts are consistent with the assumption. In particular, 89 percent of the firms in the sample have explicit income based bonus plans.[11] Table 3, however, indicates that the percentage of firms that choose LIFO is independent of whether an income based bonus plan exists.

Several control variables are used in the analysis. Total reported assets (*ASSETS*) is used as a measure of firm size. Firm size, proposed as a proxy for political visibility as well as other omitted variables, has been related to accounting choices in a number of other studies (see Holthausen and Leftwich [1983]). The political visibility hypothesis predicts that the larger the firm, the less likely are managers to choose income increasing accounting methods. It is also important to include a measure of firm size because firm size is likely to be correlated with ownership structure. Demsetz and Lehn [1985] find that larger firms have lower ownership concentration.

Following other accounting choice studies, a measure of financial leverage (*LEV*) is also included in the model. Leverage is proposed as a proxy for monitoring and contracting costs associated with debt covenants. The debt contracting hypothesis predicts that the greater the amount of debt in a firm's capital structure, the more likely are managers to choose income increasing accounting methods. *LEV* is measured as the ratio of the book value of debt to the book value of sharholder equity.

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[10] Eight of the 11 firms in the publishing industry used FIFO.

[11] The year studied in this paper is 1980. For the sample of firms used in this paper, information on management compensation contracts were obtained from 1981 proxy statements, because 1980 proxy statements were not available at the University of Michigan library. Fox [1980] reports that 90 percent of the 1,000 largest U.S. firms in 1980 had accounting income based bonus schemes. Thus, the use of 1981 proxy statements is not likely to introduce much error.

TABLE 4

DESCRIPTIVE STATISTICS

($n = 344$)

Variable	*Mean*	*Standard Deviation*	*Median*	*Minimum*	*Maximum*
OUTCON[1]	25.24	14.32	21.70	2.42	90.92
MGR	4.61	9.54	0.70	0.00	54.86
ASSETS	2.21	4.24	0.99	0.13	56.57
LEV	0.51	0.12	0.51	0.10	0.93
INVVAR	0.37	0.18	0.34	0.08	1.16

Spearman Rank Correlation Coefficients

(p-values for H_0: correlation coefficient = 0)

	OUTCON	MGR	ASSETS	LEV
MGR	−0.014 (0.801)			
ASSETS	−0.273 (0.001)	−0.453 (0.001)		
LEV	−0.018 (0.727)	0.038 (0.487)	0.082 (0.128)	
INVVAR	−0.094 (0.082)	0.112 (0.037)	0.061 (0.257)	0.066 (0.222)

[1] Variable Definitions: *OUTCON* = percentage of firm owned by the outsiders with the five largest claims.
MGR = percentage of firm owned by the managers with the five largest claims.
ASSETS = book value of net assets (in billions).
LEV = book value of debt over book value of equity.
INVVAR = coefficient of variation in year-end inventories.

Finally, a measure of inventory variability (*INVVAR*) is included. Since the present value of the tax shields from choosing LIFO is likely to be inversely related to inventory variability, the coefficient on *INVVAR* is expected to be negative. *INVVAR* was found to be significant in explaining the inventory choice by Lee and Hsieh [1985]. *INVVAR* is measured as the coefficient of variation in year-end inventories for the 1971 to 1980 period.

Descriptive statistics for the sample are presented in Table 4. Note that outside ownership is generally greater than managerial ownership (a mean of 25.24 percent vs. a mean of 4.61 percent). Also, the sample distribution of managerial ownership is highly skewed. Almost 30 percent of the observations have a zero value for *MGR*. Finally, the correlation matrix indicates that firm size is negatively correlated with both *MGR* and *OUTCON*. The only other significant (but rather low) correlations are between *INVVAR* and both *MGR* and *OUTCON*.

Univariate Analysis

Panel A of Table 5 contains the cross-classification for inventory choice by outside ownership concentration quartiles. The chi-square statistic does not allow rejection of the hypothesis that the data are drawn from a homogeneous distribution ($p = .54$). Thus, the data do

TABLE 5

UNIVARIATE ANALYSIS OF 1980 INVENTORY CHOICE AND OUTSIDE OWNERSHIP CONCENTRATION AND MANAGERIAL OWNERSHIP

($n=344$)

Panel A. Outside Ownership Concentration:

	Frequency		
	LIFO	*FIFO*	*Total*
	Number (*Percent*)	*Number* (*Percent*)	*Number* (*Percent*)
$0.00 < OUTCON < 15.45$	53 (62)	33 (38)	86 (25)
$15.45 < OUTCON < 21.71$	56 (65)	30 (35)	86 (25)
$21.71 < OUTCON < 30.72$	53 (62)	33 (38)	86 (25)
$30.72 < OUTCON < 100$	62 (72)	24 (28)	86 (25)
	$\chi^2_{(3)}=2.80$ p-level$=0.429$		

Panel B. Managerial Ownership:

	Frequency		
	LIFO	*FIFO*	*Total*
	Number (*Percent*)	*Number* (*Percent*)	*Number* (*Percent*)
$MGR = 0.00$	72 (78)	20 (22)	92 (27)
$0.00 < MGR < 3.13$	110 (66)	56 (34)	166 (48)
$3.13 < MGR < 26.31$	32 (46)	37 (54)	69 (20)
$MGR > 6.31$	10 (59)	7 (41)	17 (5)
	$\chi^2_{(3)}=18.06$ p-level$=0.001$		

not support the hypothesis that the inventory method choice is positively related to outside ownership concentration.

Panel B of Table 5 presents the cross-classification for inventory choice and four intervals of managerial ownership. As noted earlier, the managerial ownership variable *MGR* exhibits extreme skewness. Thus, instead of using quartiles as the intervals of managerial ownership, intervals were chosen that yield dispersion in managerial ownership. The results for these intervals indicate that when managerial ownership is zero, LIFO is chosen in 78 percent of the cases. When managerial ownership is between zero and 3.31 percent (the 75th percentile), the frequency of LIFO falls to 66 percent. When managerial ownership is between 3.31 percent and 26.31 percent (the 95th percentile), the frequency of LIFO drops further to 46 percent. Finally, when managerial ownership is greater than 26.31 percent, the frequency of LIFO increases to 59 percent. A chi-square test rejects at the .01 level the hypothesis that the data in the four groups are drawn from a homogeneous distribution. The results suggest that LIFO is more likely to be chosen when managerial ownership is very low or extremely high, than when managerial ownership is in the middle range.

Multivariate Analysis

A logit analysis is used to examine the effects of both *OUTCON* and *MGR* on the inventory choice simultaneously, after controlling for other determinants of the inventory choice. The dependent variable equals one if LIFO is chosen and equals zero if FIFO is chosen. The following logistic regression model is estimated:

$$\begin{aligned}\text{Prob(LIFO)} = {} & a+b_1 MGR+b_2 MGR^2\\ & +b_3 OUTCON\\ & +b_4(OUTCON\times MGR)\\ & +b_5 ASSETS\\ & +b_6 LEV\\ & +b_7 INVVAR\\ & +b_8 WOOD\\ & +b_9 ELECT\\ & +b_{10} FOOD\\ & +b_{11} PUB.\end{aligned}$$

A positive b_1 coefficient would suggest that when managerial ownership is low, greater managerial ownership helps to align the incentives of managers and shareholders. A negative b_1 coefficient would suggest that when managerial ownership is low managerial discretion increases as managerial ownership increases. A positive b_2 coefficient would suggest that the incentive alignment effect dominates when managerial ownership is high. A positive b_3 coefficient would suggest that outside ownership concentration helps mitigate incentive problems. A positive b_4 coefficient would indicate that the incentive alignment effect of managerial ownership reinforces the effect of outside ownership concentration. In contrast, a negative b_4 coefficient would indicate that the discretion effect of managerial ownerships counteracts the effect of outside ownership concentration. Finally, the coefficients on the *ASSETS*, *INVVAR*, and the industry indicator variables are expected to be negative and the coefficient on *LEV* is expected to be positive.

A finding that the b_1, b_2, b_3, and b_4 coefficient estimates are insignificantly different from zero would be consistent with one of the following conclusions: (1) the various mechanisms for motivating managers are good substitutes for one another and, therefore, managerial discretion does not vary with ownership structure, or (2) a significant conflict of interest between managers and shareholders does not exist for the inventory method choice, perhaps because the conflict can be solved at low cost by adjusting compensation contracts for the accounting method, or (3) the empirical methods and proxies cause the tests to have insufficient power.

The empirical results are presented in Table 6. Equation (1) reports the results when *MGR* is the only ownership structure variable used to explain inventory choice. In this case, managerial ownership association is negative, but not statistically significant. When the square of *MGR* is also included in the model (eqs. (2) and (4)), the coefficients on the managerial ownership variables, *MGR* and MGR^2, are negative and positive, respectively, and both are significant at conventional levels. These results indicate a non-monotonic relation between managerial ownership and the inventory method choice. The probability of choosing LIFO initially decreases with managerial ownership and then increases.

Across the different specifications, the coefficient on the outside ownership variable (*OUTCON*) is positive, as predicted, and significant at the .10 level. This result contrasts with the univariate analysis which did not indicate a relation between *OUTCON* and the inventory method choice.

TABLE 6

LOGIT ANALYSIS OF THE INVENTORY METHOD CHOICE FOR 1980

$$\text{Prob[LIFO]} = a + b_1 MGR + b_2 MGR^2 + b_3 OUTCON + b_4 MGR\ OUTCON + b_5 ASSETS + b_6 LEV + b_7 INVVAR + b_8 FOOD + b_9 WOOD + b_{10} ELECT + b_{11} PUB$$

($n=344$)

	Independent Variable (predicted sign)											
Equation	MGR (?)	MGR² (+)	OUTCON (+)	MGR• OUTCON (?)	ASSETS (−)	LEV (+)	INVVAR (−)	FOOD (−)	WOOD (−)	ELECT (−)	PUB (−)	*Pseudo*-R²
(1)	−0.006 (0.658)				0.004 (0.906)	−1.048 (0.338)	−2.895 (0.001)	−2.579 (0.001)	0.700 (0.277)	−1.351 (0.001)	−1.876 (0.009)	.13
(2)	−0.123 (0.005)	0.003 (0.007)			0.006 (0.828)	−1.332 (0.229)	−2.730 (0.001)	−2.641 (0.001)	0.634 (0.330)	−1.371 (0.001)	−1.781 (0.015)	.14
(3)			0.018 (0.066)		0.013 (0.671)	−1.088 (0.321)	−2.863 (0.001)	−2.689 (0.001)	0.798 (0.218)	−1.281 (0.001)	−2.053 (0.004)	.13
(4)	−0.116 (0.008)	0.003 (0.008)	0.018 (0.086)		0.003 (0.933)	−1.370 (0.216)	−2.694 (0.001)	−2.745 (0.001)	0.736 (0.261)	−1.302 (0.001)	−1.966 (0.009)	.14
(5)	−0.075 (0.237)	0.003 (0.021)	0.021 (0.059)	−0.002 (0.377)	0.004 (0.900)	−1.377 (0.217)	−2.696 (0.001)	−2.731 (0.001)	0.723 (0.269)	−1.324 (0.001)	−1.829 (0.016)	.14

Entries are: Coefficient Estimate (*p*-level)

Variable Definitions: See Table 4. *FOOD*, *WOOD*, *ELECT*, and *PUB* are industry dummy variables for the food, wood products, electrical equipment, and publishing industries, respectively.

The coefficient on the interaction term is not significantly different from zero. The inclusion of the interaction term, however, reduces the significance on the managerial ownership variable (*MGR*). This is probably due to the collinearity between the interaction term and *MGR* (the Spearman rank correlation coefficient is 0.98).

The coefficients on the indicator variables for the food, electronics, and publishing industries are significantly negative, indicating that firms in these industries are more likely to choose FIFO, *ceteris paribus*. The coefficient on the wood products variable, *LEV* and *ASSETS* are not statistically significant. The latter contrasts with the findings of Morse and Richardson [1983]. The difference is probably due to the lack of variation in firm size (only *Fortune 500* firms are included in this analysis). Finally, the coefficient on inventory variability (*INVVAR*) is statistically significant and has the predicted sign.

Both the univariate and the multivariate results for managerial ownership are consistent with the following interpretation. For managers with low levels of ownership, the benefit from the higher reported income outweighs the costs of higher tax liabilities. However, managers with very little ownership do not have the discretion to choose FIFO. As managerial ownership increases, managerial discretion increases and FIFO is more likely to be chosen. When managerial ownership is high, the impact of higher taxes on share price deters managers with high ownership from choosing FIFO.

Hunt [1985] found that the likelihood of LIFO was inversely related to managerial ownership. The results here for the low range of managerial ownership confirm Hunt's findings. However, over the high range of managerial ownership, there is a positive relation between the likelihood of LIFO and managerial ownership.[12]

Other Accounting Methods

For contrast, two other financial accounting choices are examined: the depreciation and investment tax credit method choices. Since firms are allowed to choose different depreciation and investment tax credit methods for tax purposes and reporting purposes, a conflict of interest is less likely to arise between managers and shareholders for these two choices.[13] Since the theory predicts that ownership structure is less likely to be related to these choices, the evidence can help validate the theory by failing to find a relation when the theory predicts one is less likely to exist.

For the depreciation and investment tax credit choices, the data are dichotomized into an income increasing group and an income decreasing group on the basis of the classifications reported in the *Value Line Data Base*. Firms for which investment tax credits are "primarily" flowed through to net income (deferred) are classified as choosing an income increasing (decreasing) ITC method. Firms which "generally" use the straight-line (accelerated) depreciation method are classified as choosing an income increasing (decreasing) depreciation method.

The variables DEP and ITC, representing the two accounting choices, take

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[12] Hunt [1985] included all members of the board of directors to calculate managerial ownership. Consequently, further comparison of these results with Hunt's results is difficult.

[13] A conflict can still exist if shareholders do not factor in the incentives of managers to choose income increasing accounting methods when compensation contracts are designed. In addition, a conflict exists with these accounting choices in the sense that shareholders prefer to pay managers lower compensation, *ceteris paribus*.

TABLE 7

LOGIT ANALYSIS FOR THE DEPRECIATION AND INVESTMENT TAX CREDIT METHOD CHOICES IN 1980

$$\text{Prob[Choice is income increasing]} = a + b_1 MGR + b_2 MGR^2 + b_3 OUTCON + b_4 OUTCON \times MGR + b_5 ASSETS + b_6 LEV$$

$(n = 344)$

		Independent Variable (predicted sign)						
Equation	*Dependent Variable*	MGR (?)	MGR^2 (?)	OUTCON (?)	OUTCON ×MGR (?)	ASSETS (−)	LEV (+)	*Pseudo*-R^2
(1)	DEP	−0.053 (0.193)	0.001 (0.366)	−0.013 (0.172)		−0.035 (0.231)	2.970 (0.021)	0
(2)	DEP	−0.047 (0.472)	0.001 (0.451)	−0.013 (0.212)	0.000 (0.892)	−0.035 (0.233)	2.976 (0.021)	0
(3)	ITC	−0.002 (0.973)	0.000 (0.930)	−0.003 (0.836)		−0.010 (0.792)	3.188 (0.034)	0
(4)	ITC	−0.032 (0.499)	0.000 (0.769)	−0.004 (0.741)	0.001 (0.672)	−0.011 (0.792)	3.161 (0.039)	0

Entries are: Coefficient Estimate (*p*-level)

the value of one if the choice is income increasing and zero if it is income decreasing. For the depreciation and investment tax credit choices, the income increasing choice is chosen in 73 percent and 89 percent of the cases, respectively.

Table 7 reports the results for the depreciation method and investment tax credit choices. In all of the equations, the ownership structure variables are insignificantly different from zero. Dhaliwal et al. [1982] report that manager-controlled firms are more likely to choose an income increasing depreciation method. The results reported in Table 7, however, do not corroborate the Dhaliwal et al. finding. Moreover, no statistical relation is found between the depreciation method choice and the dichotomous manager-controlled, owner-controlled classification variable used by Dhaliwal et al.[14]

The lack of results for the depreciation and investment tax credit choices lend some support to the conclusion that the statistical relation between the inventory choice and ownership structure is not spurious. The accounting choice for which a conflict of interest is most likely to arise is related to ownership structure, but the choices for which a conflict is less likely to arise are not related to ownership structure.

III. SUMMARY

Accounting choices and ownership structure may be related if (1) there is a potential conflict of interest between managers and shareholders over accounting choices, and (2) ownership structure affects the resolution of incentive conflicts between managers and shareholders.

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[14] One difference in the two studies is Dhaliwal et al. [1982] eliminated firms from their sample that did not use an accelerated depreciation method for tax purposes.

This paper focuses on the inventory method choice because it is the accounting choice for which a conflict of interest is most likely to arise. The IRS requires firms that use the LIFO inventory method for tax purposes to also use LIFO for reporting purposes. When LIFO is the tax minimizing method, shareholders are likely to prefer the use of LIFO. However, if managers' compensation is positively related to reported income, managers may prefer the FIFO method. Consequently, managers and shareholders can have conflicting interests when LIFO is the tax minimizing method.

The economics literature provides several hypotheses regarding ownership structure and the resolution of incentive conflicts. First, increases in the concentration of outside ownership is likely to reduce agency problems by increasing the level of monitoring. This hypothesis predicts that the probability of choosing LIFO increases with outside ownership concentration when LIFO is the tax minimizing inventory method. The empirical evidence presented in the paper supports this prediction.

Two other hypotheses relate managerial ownership to the resolution of agency problems. One hypothesis is that higher levels of managerial ownership mitigate agency problems by aligning the incentives of managers and shareholders. The other hypothesis is that higher managerial ownership gives managers more discretion. The combination of these two hypotheses can lead to a non-monotonic relation between managerial ownership and the inventory method choice. The empirical evidence presented here is consistent with such a relation: the probability of choosing LIFO initially decreases as managerial ownership increases. Beyond a point, however, the probability of choosing LIFO increases with managerial ownership.

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Audit Structure and Its Relation to Role Conflict and Role Ambiguity: An Empirical Investigation

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ABSTRACT: The trend towards more structure in some of the largest accounting firms' audit methodologies has generated considerable interest, but little empirical evidence. This study provides evidence on the role conflict and role ambiguity perceived by audit seniors in structured versus unstructured accounting firms. Role theory provides a basis for analyzing the effects of audit structure on the organizational characteristics which are potential sources of role conflict and ambiguity. The results are based on a sample of 67 seniors from structured and 54 seniors from unstructured firms. The seniors' perceptions of their firms' organizational characteristics and their perceived role stress differed systematically across structured versus unstructured firms. No evidence is found of the concerns (such as inflexibility in atypical audit environments) that have been raised regarding the trend towards increasing audit structure.

IN an attempt to simultaneously improve audit quality and audit efficiency, several of the largest accounting firms have adopted a more structured approach to their audit process. Cushing and Loebbecke [1986, p. 50] have described this trend as "an intriguing development that deserves additional consideration by auditing researchers and practitioners, and perhaps by the Auditing Standards Board." This study examines audit structure from the perspective of the field auditors who are responsible for applying their firm's particular audit approach. The study's primary objective is to determine the association between the degree of structure of the audit approach (as documented by Cushing and Loebbecke [1986]) and the role conflict and ambiguity experienced by audit seniors.

Organizational behavior research (for reviews, see Cummings [1982] and Dalton et al. [1980]) often finds that structure has important effects, at both the individual and organizational levels. Consistent with this, auditing researchers have identified potential advantages and potential disadvantages of increased audit structure (e.g., Dirsmith and McAllister [1982a; 1982b], Ashton [1983], and Cushing and Loebbecke [1986]). Potential advantages include better quality control of audit work, staff training, communication among auditors, and cost effectiveness. Possible disadvantages of

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too much structure include inflexibility in atypical audit environments, over-auditing of small or low-risk clients, shifting too much control away from the field auditor, and increased demands on engagement management.

These potential effects of audit structure are likely to influence the ambiguity and conflict that auditors, especially field auditors, associate with their organizational roles. Indeed, Senatra [1980] found that measures of audit seniors' role conflict and role ambiguity were significantly related to (1) the seniors' perceptions of their firm's organizational climate (in which structural variables play an important role), and (2) the seniors' job satisfaction and job-related tension. Auditing research has recognized both the potential for conflict and ambiguity in audit roles, and their potential consequences in the form of stress, turnover, and reduced levels of performance [Montagna, 1968; Schultz, 1974; Sorensen and Sorensen, 1974; Baker, 1977; Senatra, 1980; and Choo, 1986]. The current study assumes that role conflict and ambiguity can adversely affect auditors and audit performance,[1] and focuses upon audit structure as an antecedent condition to role conflict and ambiguity.

The paper is organized into four sections. The first section discusses the primary variables (audit structure, role ambiguity, and role conflict) examined in the study, and presents the framework on which our hypotheses are based. The second section describes the method used in the empirical investigation. The third section reports the results, and the final section presents the conclusions and implications of the study.

THEORETICAL FRAMEWORK

Audit Structure

The meaning of audit structure and the location of particular firms along that dimension have been topics of recent debate (e.g., Sullivan [1984] and Mullarkey [1984]). Underlying this discussion may be the fact that Cushing and Loebbecke's definition of "structure"[2] encompasses elements of both structure and technology, which more traditional organizational research treat as distinct constructs. *Structure* has been defined as the arrangement of people, tasks, and authority to achieve more calculable and predictable control over organizational performance [Ranson et al., 1980], and it is often described in terms of a mechanistic-organismic continuum [Burns and Stalker, 1961]. Cushing and Loebbecke [1986, p. 32] acknowledge that their definition of audit structure is "not inconsistent" with that continuum.[3] In contrast, *technology* refers to the means by which inputs are transformed into outputs [Fry, 1982]. The prominent roles ascribed to audit tools and decision aids by Cushing and Loebbecke [1986] and Kinney [1986], suggest technology also plays a part in audit structure. Accordingly, the framework and hypotheses developed subsequently include both organizational structure and technological aspects of audit structure.

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[1] Numerous studies in the organizational literature (and the meta-analysis by Jackson and Schuler [1985]) find that role ambiguity and role conflict are associated with unfavorable outcomes for both the individual and the organization.

[2] Cushing and Loebbecke [1986, p. 32] define a structured audit methodology as "...a systematic approach to auditing characterized by a prescribed, logical sequence of procedures, decisions, and documentation steps, and by a comprehensive and integrated set of audit policies and tools to assist the auditor in conducting the audit."

[3] Mechanistic organizations generally have specific goals, explicit policies and procedures, a high level of formalization, centralized decision making, and top-down communication. Organismic organizations, on the other hand, tend to have implicit goals and directions, intergroup cooperation, decentralized decision making, a low level of formalization, and open communications. Dirsmith and McAllister [1982a; 1982b] have described "mechanistic audits" and "organic audits" in terms of this continuum.

Role Conflict and Role Ambiguity

Role conflict refers to the presence of incompatible role pressures. Wolfe and Snoek [1962, p. 103] succinctly define role conflict as: "...the simultaneous occurrence of two (or more) sets of pressures such that compliance with one would make difficult or impossible compliance with the other." Various types of role conflict (between the time, resources, capabilities, or values of the individual and defined role behavior; between two or more roles for the same individual; and through incompatible policies, standards of evaluation, requests, and expectations of others) have been identified [Rizzo et al., 1970].

Though often examined simultaneously with role conflict, *role ambiguity* is a theoretically distinct construct [Jackson and Schuler, 1985]. Rizzo et al. [1970, pp. 155–156] define role ambiguity "...in terms of (1) the predictability of the outcome or responses to one's behavior..., and (2) the existence or clarity of behavioral requirements, often in terms of inputs from the environment, which would serve to guide behavior and provide knowledge that the behavior is appropriate...." Thus, nonexistent or unclear directives and policies, uncertainty about authority, duties and relations with others, and uncertainty as to the effect of behaviors on sanctions and rewards should increase role ambiguity.

Framework

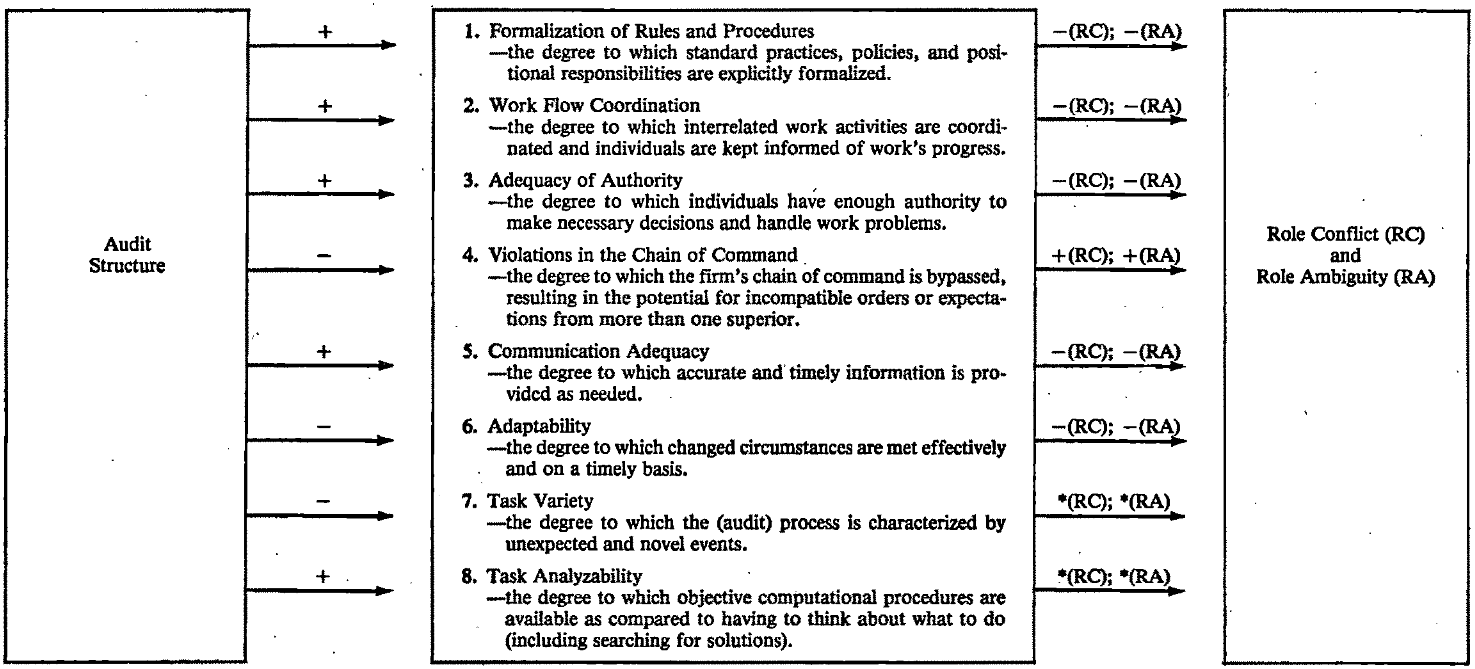
The study's primary hypothesis is that less role conflict and ambiguity will be experienced by auditors from firms using structured audit methodologies (as defined by Cushing and Loebbecke [1986]) than by auditors from unstructured firms. The underlying propositions are that: (1) auditors' perceptions of organizational practices and task-technology will differ between the two types of firms, and (2) the role conflict and role ambiguity that auditors experience are related to their perceptions of these organizational characteristics.

The Relation Between Audit Structure and Organizational Characteristics. Figure 1 explains each organizational characteristic included in the study and predicts how audit structure will affect each one. The expectations are based on the organizational behavior and audit structure literature discussed earlier. To the extent that audit structure involves a structuring of audit tasks, seniors from highly structured firms should perceive that their roles are more subject to formalized rules and procedures (i.e., greater formalization). Work flow coordination is often associated with formalization [Rousseau, 1978] and, accordingly, we posit that seniors in highly structured firms will perceive greater work flow coordination. Consistent with findings relating to more mechanistic structures [Rizzo et al., 1970], audit seniors from more structured firms are more likely to perceive their authority as adequate, and experience fewer violations in the chain of command, than will their counterparts from less-structured firms. Cushing and Loebbecke [1986] have suggested that audit structure may facilitate communication, hence we posit that audit seniors from highly structured firms will perceive greater adequacy of communication. Finally, the concern about audit structure's possible inflexibility in atypical audit environments suggests that subjects in highly structured firms may perceive their adaptability to be less than that of auditors in less structured firms.

Audit seniors from both structured and unstructured firms are likely to per-

FIGURE 1

THE RELATION BETWEEN AUDIT STRUCTURE, PERCEPTIONS OF ORGANIZATIONAL PRACTICES AND TASK-TECHNOLOGY, AND ROLE CONFLICT AND ROLE AMBIGUITY



1. Formalization of Rules and Procedures
   —the degree to which standard practices, policies, and positional responsibilities are explicitly formalized.
2. Work Flow Coordination
   —the degree to which interrelated work activities are coordinated and individuals are kept informed of work's progress.
3. Adequacy of Authority
   —the degree to which individuals have enough authority to make necessary decisions and handle work problems.
4. Violations in the Chain of Command
   —the degree to which the firm's chain of command is bypassed, resulting in the potential for incompatible orders or expectations from more than one superior.
5. Communication Adequacy
   —the degree to which accurate and timely information is provided as needed.
6. Adaptability
   —the degree to which changed circumstances are met effectively and on a timely basis.
7. Task Variety
   —the degree to which the (audit) process is characterized by unexpected and novel events.
8. Task Analyzability
   —the degree to which objective computational procedures are available as compared to having to think about what to do (including searching for solutions).

* No expectations posited.

ceive their tasks as relatively routine (particularly since managers and partners generally assume greater responsibility when atypical situations arise).[4] However, the greater centralization of decision making associated with highly structured firms [Cushing and Loebbecke, 1986] should heighten perceptions of task routineness. Moreover, structured firms' integration of specific forms of technology (such as preprinted forms, checklists, decision matrices, and other guidelines) into the audit approach reflects the philosophy that audit tasks are generally programmable. Since this technology is largely focused on audit seniors' task responsibilities, seniors in these firms should perceive their tasks as more analyzable and less variable.

The Relation Between Organizational Characteristics and Role Conflict and Ambiguity. Figure 1 also summarizes the expected relations between (1) perceptions of organizational practices and task-technology, and (2) perceptions of role conflict and ambiguity. The directional relations are consistent with House and Rizzo [1972a] and Senatra [1980]. House and Rizzo [1972a] found that the six organizational practice variables shown in Figure 1 were related to role stress (i.e., role conflict and ambiguity). While their examination was limited to one firm, subsequent studies have replicated and extended their findings (for a review, see Jackson and Schuler [1985]). Senatra's [1980] study examined nine organizational practice variables as predictors of audit seniors' role stress in a single Big Eight firm.[5]

While the directions of the relations should be the same as Senatra [1980] reports, this does not preclude differences in the significance of the relations. For example, violations in the chain of command might occur less frequently within structured firms, but may lead to greater role stress when they do occur. On the other hand, if reduced adaptability is a particularly significant disadvantage of the structured audit approach, then the relation between adaptability and role stress may be more significant for those firms. Figure 1 does not include specific hypotheses of this kind because of the preliminary state of research on audit structure and its effects.

This study is also exploratory with respect to relations between the routineness of the task-technology and role perceptions. Though a negative relation between task routineness and role ambiguity is intuitively appealing, the literature yields neither a theoretical nor a strong empirical basis for expecting particular relations.[6]

METHOD

Sample and Procedure

Audit seniors were chosen as subjects in this study since structured audit methodologies are primarily aimed at directing efforts in the field. Offices of four Big Eight accounting firms participated in the study. According to Kinney's

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[4] Ballew [1982] points to participation in determining professional standards, constraints imposed by auditing and accounting standards, and retention of audit clients, as factors underlying his expectation that technological routineness would be higher for audit teams than other teams functioning within public accounting firms. However, Ballew's findings were not fully consistent with his expectations.

[5] Less formalization, violations in the chain of command, and inadequate communications were significantly associated with increased role conflict; violations in the chain of command and inadequacy of authority were associated with increased role ambiguity.

[6] Schuler [1977] and Rogers and Molnar [1976] (among others) have suggested that role perceptions may depend on interactions between task-technology and other organizational characteristics. We believe that such interaction effects are unlikely in the audit setting because (1) it is unlikely that firms will differ sufficiently in structure and technology to cause an interaction, and (2) increased audit structure is argued to be associated with greater organizational structure *and* greater technological routineness.

[1986] classification, these four firms are comprised of two firms from the structured end of Cushing and Loebbecke's [1986] scale, and two firms from the unstructured end. To reduce any potential office effects, four offices from each firm provided subjects.

Each office's managing partner or another liaison person arranged distribution of the questionnaire to the office's audit seniors. Each participant sealed the completed questionnaire in an accompanying envelope before returning it to the liaison person for mailing. A total of 133 questionnaires were returned—a response rate of close to 100 percent. Twelve questionnaires with missing responses were omitted from the analysis, leaving 121 usable responses (67 from the two structured firms and 54 from the two unstructured firms). The participants' average years of experience was slightly more than three years, with a range of one to six years.

Measures

Cushing and Loebbecke [1986] developed their classification of audit approaches inductively from their empirical results. Their approach may be described as an "institutional" approach based on firm materials and interviews with key personnel. In contrast, our study used an organizational behavior-based questionnaire to measure audit seniors' perceptions.[7]

Role Conflict and Role Ambiguity. The role conflict (eight-item scale) and role ambiguity (six-item scale) measures were developed by Rizzo et al. [1970] to measure role stress in complex organizations. Their sample consisted of managers and research and engineering personnel. Schuler et al. [1977] analyzed the scales' psychometric properties on six samples from three different industries. They reported a range of .56 to .83 for the scales' internal consistency reliabilities. Based on this and additional tests (including an analysis of factor structure, test-retest reliabilities, and correlations with other attitudinal and behavioral variables), they concluded that the scales are valid measures and recommended their continued use. Most subsequent research on role theory, including Senatra's [1980] study, has used these measures [Jackson and Schuler, 1985].

Structure and Organizational Practices. Measures of organizational practices were obtained from House and Rizzo's revised Organizational Practices Questionnaire [Rizzo et al., 1970; House and Rizzo, 1972b]. As originally designed, the questionnaire provided measures (or scales) for 19 variables. The six organization variables used in the current study (see Fig. 1) reflect our specific interest in the structural aspects of accounting firms. House and Rizzo [1972b] verified their measures using Campbell and Fiske's [1959] validation techniques. The scales' convergent validity was tested in terms of the convergence between their measures and other conceptually related measures: Campbell and Fiske's three tests of discriminant validity were used to test whether the scales captured distinct constructs. House and Rizzo concluded that the questionnaire satisfied convergent and discriminant validity requirements, as well as the reliability criterion (the scales' average internal consistency was .71).

Technology. This study uses Daft and

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[7] The questionnaire included a scale, tolerance for ambiguity [MacDonald, 1970], which is not discussed in the section. This scale was included to provide one measure of individual differences and, specifically, to test whether personality moderated the organizational effects examined in this study. It is excluded from the discussion and the reported analyses because the seniors' tolerance for ambiguity was not significantly different between firms, nor was it a significant covariate in any of the analyses undertaken.

Macintosh's [1981] technology scale. The scale is based on Perrow's [1967] conceptualization of technology at the individual task level in terms of routine-nonroutine work. They used 14 organizations in the scale development, including respondents from manufacturing and the education, legal, and accounting professions. Following Perrow, the scale is composed of two subscales. The first scale, task variety (six items), measures the frequency of unexpected and novel events. Low variety means there is considerable certainty about the occurrence of future activities. The second scale, task analyzability (five items), concerns the way in which individuals respond to problems that arise. An objective computation procedure is available for analyzable tasks; for other tasks, time must be spent thinking about what to do, and active search for solutions may be required. Withey et al. [1983] evaluated Daft and Macintosh's scales as well as five other instruments used to assess Perrow's dimensions of technology. Daft and Macintosh's instrument performed best on the reliability criterion (internal consistency of .69 for analyzability and .73 for variety) and, based on convergent and discriminant validity criteria, was identified as "one of the better instruments" [p. 57].

The measures used in this study were not specifically developed for the auditing setting. However, the measures have been used in managerial settings where the respondents (like auditors) have some degree of autonomy. Only minor modifications (e.g., replacing the term "work group" with "audit team") were needed to accommodate the study's audit setting. Moreover, the several auditors from each participating firm who pretested the research instrument indicated no difficulty in understanding the questions or using the response scales.[8]

As described earlier, organizational behavior research has tested the validity and reliability of each of the chosen scales. We also examined the scales' internal consistency reliabilities [Cronbach, 1951]. Table 1 reports the results. Overall, the values denote moderate reliabilities, similar to those typically found in the organizational literature, which are acceptable for testing relations. The one unacceptable result was a reliability coefficient of .36 for task variety.

RESULTS

The results are presented in four parts. First, results for differences in perceived organizational characteristics of structured versus unstructured firms are presented. This is a test of the left hand side of the model in Figure 1. The second section concerns our primary hypothesis and reports on differences in role conflict and ambiguity between the two types of firms. Third, as a test of the right hand side of the model, we examine the relations between role conflict and ambiguity and their potential sources (i.e., organizational characteristics). This analysis includes all four firms (without considering the structured-unstructured firm dichotomy) and provides a basis for assessing the study's consistency with prior research. Finally, we explore whether these relations differ systematically between structured and unstructured firms.

Differences in Organizational Characteristics Between Structured and Unstructured Firms. The model presented in Figure 1 hypothesizes that the known differences in the structure of firms' audit

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[8] All items in the questionnaire were answered on five-point anchored response scales. The anchors were "To a Very Little Extent"-"To a Very Great Extent" for the technology items and "Strongly Disagree"-"Strongly Agree" for all other items.

TABLE 1

INTERNAL CONSISTENCY RELIABILITIES FOR MEASURES

($n = 121$)

Measure	*Reliability Coefficient*[a]
Role conflict	.71
Role ambiguity	.82
Formalization of rules and procedures	.73
Work flow coordination	.61
Adequacy of authority	.70
Violations in chain of command	.59
Communication adequacy	.73
Adaptability	.60
Task variety	.36
Task analyzability	.72

[a] The (internal consistency) reliability coefficient represents the average intercorrelation of repeated random subsamples of items from the scale [Kerlinger, 1973, pp. 451–455].

methodologies will be associated with perceptual differences in firms' organizational characteristics. Table 2 shows the mean scores and standard deviations obtained for these characteristics. The structured firm versus unstructured firm mean score vectors are significantly different according to Hotelling's T^2-test ($T^2 = 15.48$, $p = .08$ assuming homogeneous variances; $T^2 = 13.54$, $p = .09$ assuming nonhomogeneity—not included in Table 2).[9]

Post hoc tests reveal which organizational characteristics contribute most to the multivariate difference. These one-tailed t-test results (see Table 2) show that, as hypothesized, seniors from structured firms had different perceptions regarding both task-technology and organizational practices than those of seniors from unstructured firms. Structured firm seniors perceived their tasks as more analyzable than did seniors in unstructured firms ($p < .01$). That is, consistent with the notion of a structured audit methodology, they viewed their technology as involving greater use of available objective computation procedures, as opposed to active search for solutions beyond normal approaches.

Structured firm seniors also perceived their work to be characterized by greater formalization of rules and procedures ($p < .04$), adequacy of authority ($p < .03$), communication adequacy ($p < .09$) and, in the opposite direction to that hypothesized, adaptability ($p < .06$). The latter three results do not necessarily indicate structured firm seniors had greater absolute authority, communication, or adapt-

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[9] This nondirectional statistical test result is conservative, since seven of the eight differences in organizational variables are in the hypothesized direction. These and the subsequently reported differences between structured and unstructured firm auditors are even more impressive when the similarities between the two firms within each category are recognized. The same test (Hotelling's T^2) found no significant differences ($p > .5$) between the two structured firms, nor between the two unstructured firms. Moreover, for those characteristics subsequently reported as significantly different between structured and unstructured firms, neither the difference between the two structured firms nor the difference between the two unstructured firms was significant at $p = .20$ (one characteristic was an exception, at $p = .1$). Finally, the order of firms' mean scores is entirely consistent (e.g., both structured firms' mean scores for formalization are larger than the corresponding scores for the two unstructured firms).

TABLE 2

DIFFERENCES BETWEEN STRUCTURED AND UNSTRUCTURED FIRMS' AUDIT SENIORS' PERCEPTIONS OF ORGANIZATIONAL PRACTICES, TASK-TECHNOLOGY, AND ROLE CONFLICT AND AMBIGUITY

Measures	*Mean Score (Standard Deviation) For Structured Firms*	*Mean Score (Standard Deviation) For Unstructured Firms*	*t-statistic*
Formalization of rules and procedures	3.84 (.520)	3.67 (.533)	1.75**
Work flow coordination	3.62 (.611)	3.52 (.615)	.86
Adequacy of authority[a]	3.79 (.441)	3.59 (.610)	1.98**
Violations in chain of command	2.73 (.541)	2.82 (.520)	−.91
Communication adequacy	3.66 (.484)	3.53 (.508)	1.35*
Adaptability	3.45 (.536)	3.29 (.575)	1.56*
Task variety[a]	3.18 (.382)	3.25 (.508)	−.87
Task analyzability[b]	2.53 (.448)	2.81 (.534)	−3.06***
Role conflict[a]	2.27 (.471)	2.48 (.609)	−2.08**
Role ambiguity[a]	2.24 (.480)	2.36 (.652)	−1.18
	$n_1=67$	$n_2=54$	

[a] Variable had unequal variances when tested by the folded form of the F-statistic [Winer, 1971, pp. 39–40]. In these cases, the t-statistic was computed under the assumption of unequal variances, and Satterthwaite's [1946] approximation for the degrees of freedom was employed.

[b] Task analyzability has reverse scoring, so that a high score indicates less analyzability (and less routineness), just as a higher score for task variety indicates more variety (and less routineness). A five-point response scale was used for all measures.

* Significant at the .10 level (one-sided).

** Significant at the .05 level (one-sided).

*** Significant at the .01 level (one-sided).

ability. Rather, they may indicate the seniors perceived they had more adequate levels of these characteristics for the demands placed on them.

Differences in Role Stress Between Structured and Unstructured Firms. Mean scores for role conflict and role ambiguity also appear in Table 2.[10] As hypothesized, the mean level of role conflict for unstructured firm seniors is significantly higher ($p<.02$) than that for seniors in the structured firms. That is, on average, unstructured firm seniors experience greater incompatibility between the requirements and available resources associated with their role. The mean level of role ambiguity is higher for unstructured firm seniors (as hypothesized), but the difference is of only marginal statistical significance ($p<.12$).

Role Conflict, Role Ambiguity, and Organizational Characteristics. The right hand side of the model presented in Figure 1 hypothesizes relations between certain organizational practices and technology and role conflict and ambiguity. Table 3 presents these relations for the sample as a whole (i.e., the 121 seniors from all four firms). The coefficients of multiple determination (R^2) reported in the table show that the eight measures of the seniors' perceptions of

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[10] The mean levels of role stress in this study are lower than those obtained in a stressful organizational climate by House and Rizzo [1972a]. Mean scores for both role conflict and ambiguity were close to the scale midpoints in House and Rizzo's study. However, role stress measures varied widely across individuals in the current study. For the sample as a whole, scores range from 1.38 to 4.13 for role conflict, and from 1.00 to 4.50 for role ambiguity. (Standard deviations are included in Table 2.)

TABLE 3
THE RELATIONS BETWEEN ROLE CONFLICT, ROLE AMBIGUITY, AND THEIR POTENTIAL ORGANIZATIONAL SOURCES
($n=121$)

	Role Conflict		*Role Ambiguity*	
Measures	r	β	r	β
Intercept		5.07***		3.94***
Formalization of rules and procedures	−.38	−.06	−.47	−.10
Work flow coordination	−.51	−.13*	−.65	−.33***
Adequacy of authority	−.50	−.22***	−.36	−.05
Violations in chain of command	.48	.13	.53	.26***
Communication adequacy	−.60	−.24**	−.64	−.29***
Adaptability	−.53	−.20***	−.35	.05
Task variety	−.18	−.05	−.09	.06
Task analyzability	.14	.05	.17	.03

Role Conflict $R^2=.519$ ($\hat{R}^2=.484$); $F=15.09$***

Role Ambiguity $R^2=.574$ ($\hat{R}^2=.544$); $F=18.87$***

* Significant at the .10 level.
** Significant at the .05 level.
*** Significant at the .01 level.

organizational characteristics account for a statistically significant ($p<.01$) amount of the variance in seniors' role conflict and role ambiguity.

In order to examine the relations between the dependent and independent variables, Table 3 also includes the zero-order correlation coefficients (r) and the partial regression coefficients (β).[11] The Table 3 results suggest that there is a different relation between the independent variables and role conflict versus role ambiguity. This is consistent with Senatra's [1980] finding that role conflict and role ambiguity are distinct constructs which both require attention in the audit setting. Work flow coordination, adequacy of authority, communication adequacy, and adaptability all contributed significantly to role conflict in the directions hypothesized in Figure 1. Work flow coordination, violations in the chain of command, and communication adequacy contributed significantly to role ambiguity in the hypothesized directions. The remaining relations (except for that between adaptability and role ambiguity) were in the hypothesized direction, but not statistically significant.

Potential Sources of Role Conflict and Ambiguity in Structured Versus Unstructured Firms. The analysis presented in Table 4 is used to explore the relations between organizational characteristics and role conflict and ambiguity in structured versus unstructured firms. As discussed earlier, since so little is known about the effects of audit structure, no specific hypotheses were established concerning differences in these relations between the two types of firms. Table 4 presents results analogous to those re-

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[11] The zero-order (simple) correlations indicate the direction and strength of the unconditional relation between each independent and dependent variable. The regression coefficients are used to test incremental explanatory power of each independent variable.

TABLE 4

MEASURES OF THE RELATIONS BETWEEN ROLE CONFLICT, ROLE AMBIGUITY, AND THEIR POTENTIAL SOURCES IN STRUCTURED AND UNSTRUCTURED FIRMS

	Structured		Unstructured		
Role Conflict	r	β	r	β	t-*statistic for* $H_o:\beta_1=\beta_2$
Intercept		3.41***		6.98***	2.42**
Formalization of rules and procedures	−.33	−.12	−.38	−.02	.52
Work flow coordination	−.35	−.03	−.67	−.19	−.86
Adequacy of authority	−.29	−.05	−.61	−.26**	−1.23
Violations in chain of command	.57	.32***	.40	−.15	−2.69***
Communication adequacy	−.51	−.14	−.68	−.42**	−1.24
Adaptability	−.45	−.12	−.59	−.36***	−1.54
Task variety	−.27	−.09	−.15	.02	.69
Task analyzability	.00	.00	.18	.06	.34

Structured $R^2=.433$ ($\hat{R}^2=.355$); $n=67$; $F=5.54$***

Unstructured $R^2=.685$ ($\hat{R}^2=.628$); $n=54$; $F=12.20$***

	Structured		Unstructured		
Role Ambiguity	r	β	r	β	t-*statistic for* $H_o:\beta_1=\beta_2$
Intercept		2.56***		6.20***	2.43**
Formalization of rules and procedures	−.37	−.02	−.54	−.31*	−1.47
Work flow coordination	−.59	−.28***	−.71	−.29	−.01
Adequacy of authority	−.28	−.11	−.39	−.04	.40
Violations in chain of command	.58	.36***	.49	.10	−1.48
Communication adequacy	−.56	−.20*	−.71	−.43**	−.98
Adaptability	−.33	.11	−.35	−.07	−1.11
Task variety	−.21	.02	−.03	.11	.54
Task analyzability	.19	.21**	.12	−.17	−2.17**

Structured $R^2=.592$ ($\hat{R}^2=.535$); $n=67$; $F=10.51$***

Unstructured $R^2=.619$ ($\hat{R}^2=.551$); $n=54$; $F=9.12$***

* Significant at the .10 level (two-sided).
** Significant at the .05 level (two-sided).
*** Significant at the .01 level (two-sided).

ported in Table 3, but calculated separately for the structured and unstructured firms. Again, each regression model is statistically significant ($p<.01$). In the models for structured firms, role conflict is significantly associated with violations in the chain of command; role ambiguity is significantly associated with work flow coordination, violations in the chain of command, communication adequacy, and task analyzability. For unstructured firm seniors, adequacy of authority, communication adequacy, and adaptability are all significantly related to role conflict; formalization of rules and procedures and communication adequacy are significantly related to role ambiguity.[12]

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[12] Similar analyses were also performed at the firm level. Despite the reduced sample sizes, each characteristic (in Table 4) that was significant at the .05 level or better for the structured firms was also significant for each individual firm. For the two unstructured firms, this was the case only for adaptability, suggesting relatively greater diversity among unstructured firms.

These results suggest both similarities and differences between the structured and unstructured firms. Perceived deficiencies in communication (i.e., the provision of accurate and timely information as needed) is related to role stress in both types of firms. In addition, structured firm seniors appear sensitive to superiors bypassing the chain of command, inadequate work flow coordination, and lower task analyzability. For seniors from unstructured firms, the lack of perceived authority to make necessary decisions, including handling problems that arise, and the inability to adapt on a timely basis to changed circumstances appear to be particularly associated with role stress.

Table 4 also provides the results of testing the magnitude of the relations between organizational characteristics and role conflict and ambiguity. The statistically significant differences between structured and unstructured firms' intercepts are consistent with the higher role conflict and ambiguity indicated by subjects in the unstructured firm. The significantly higher regression coefficients for violations in the chain of command and task analyzability (reverse scoring) for structured firm seniors suggests that they are more sensitive (in terms of role conflict) to violations in the chain of command and more sensitive (in terms of role ambiguity) to lack of task analyzability. These findings provide limited evidence that the magnitudes of the relations between organizational characteristics and role stress also differ across structured and unstructured firms.[13]

SUMMARY, CONCLUSIONS, AND IMPLICATIONS

This study modeled and examined relations between role conflict and ambiguity and perceived organizational characteristics in four Big Eight accounting firm that differed in the structure of their audit approach. The perceptions of the audit seniors who participated in the study generally were consistent with Cushing and Loebbecke's institutionally based distinctions between structured and unstructured firms. Compared to their counterparts in unstructured firms, structured firm seniors perceived their tasks as more analyzable and perceived a greater degree of explicit formalization of standard practices, policies, and position responsibilities. No significant differences were found with respect to the extent to which interrelated work activities are coordinated or the extent which audit seniors are kept informed.

In concluding that role conflict and role ambiguity are distinct constructs in the audit setting, the study provides support for prior research by Senatra [1980]. Moreover, relations between perceived organizational characteristics and role stress generally were in directions consistent with prior research and expectations. Work flow coordination, adequacy of authority, communication adequacy, and adaptability were related significantly to role conflict; work flow coordination, violations in the chain of command, and communication adequacy were related significantly to role ambiguity.

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[13] Given these differences, we explored whether Senatra's [1980] results (based on one firm) matched our results for a particular firm type (i.e., structured or unstructured). The Fisher *Z*-test [Cohen and Cohen, 1983, pp. 53–55] can be used to test zero-order correlation coefficients across studies. Five of the organizational characteristics are included in both Senatra's and our study. Correlating each of these five characteristics with both role conflict and ambiguity enables ten comparisons. Only two of Senatra's correlations are significantly different from our structured sample (adequacy of authority and violations in chain of command with role ambiguity), while six are significantly different from our unstructured sample. This suggests that Senatra's subjects' perceptions were more similar to the perceptions of our structured firm subjects.

As specified in the study's primary hypothesis, the role stress perceived by our participants from unstructured firms appeared greater than that perceived by structured firm participants. The difference was especially marked (statistically significant at $p<.02$) for role conflict; the difference was of marginal statistical significance ($p<.12$) for role ambiguity. Moreover, evidence of differences in the relations between organizational characteristics and role stress was obtained for structured versus unstructured firms.

The results of the study offer insight into two important issues: Is the trend towards greater structure desirable? How might the role stress experienced by auditors be alleviated? The appropriateness of the increased use of structured audit methodologies cannot be assessed simply by perceptual data. Where seniors' perceptions regarding organizational characteristics differed significantly between structured and unstructured firms, however, the more positive responses came from structured firm seniors. In addition, the structured firm seniors reported significantly lower levels of role conflict (and somewhat lower role ambiguity) than seniors from unstructured firms. At least for the firms and variables in our study, negative reactions by auditors to increased audit structure appear to have been avoided.

By itself, the study cannot provide a basis for choosing actions to reduce role stress. Other factors, including other organizational practices, could affect the relations reported. However, some implications for action would differ according to whether or not firms utilize structured audit methodologies. In particular, as part of an effort to alleviate seniors' perceptions that they are subject to inconsistent demands (i.e., role conflict), unstructured firms might critically evaluate the authority delegated to seniors, and their information and flexibility requirements.[14] For structured firms, efforts to reduce role ambiguity might entail critical evaluation of the adherence to the chain of command, work flow coordination, and information needs. Violations in the chain of command (though perceived to occur less frequently than in unstructured firms) should be of particular concern to structured firms.

The significant results obtained, their internal consistency, and their consistency with prior research (including the work of Cushing and Loebbecke [1986]) are positive indicators of the validity of the study's findings.

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[14] These seniors do not necessarily require, for example, greater delegated authority. However, there needs to be a better match between perceived task demands and the perceived authority delegated to achieve those demands.

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NOTES

The Economic Benefits of Regulation: Evidence from Professional Tax Preparers

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ABSTRACT: An area of concern to tax policymakers is the role of third-party preparers in income tax reporting. This research examines the degree of consistency in judgments of preparers subject to differing degrees of governmental regulation. Economic theory of regulation suggests that CPAs, who are subject to a higher degree of government regulation, would be expected to recommend and justify more pro-taxpayer positions in ambiguous areas of tax law than would unlicensed preparers. This hypothesis was tested by administering a set of tax cases with a high degree of uncertainty regarding the correct tax status to groups of CPA and non-CPA tax practitioners. CPAs were found to be consistently more pro-taxpayer than were non-CPAs.

MANY areas of tax law are ambiguous in that the tax owed depends on the interpretation of complex provisions of the law. The role of third-party preparers has become a critical part of the present system of voluntary compliance in determining the tax owed in these areas [Klepper et al., 1988; Scotchmer, 1987; and Jackson et al., 1988]. The complexity involved in tax return preparation is evidenced by the fact that recent Internal Revenue Service (IRS) data shows that approximately 60 percent of all but the simplest returns are professionally prepared [IRS, 1988]. The belief that tax practitioners are having an impact on the distributional equity of the tax system has led the IRS and the Treasury to seek increased preparer penalties and the imposition of more rigorous standards of conduct for those practitioners having the right to practice before the IRS [Shapiro, 1987].

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The purpose of this research is to assess whether differences exist across categories of preparers who are subject to different levels of governmental regulation. We argue that the regulatory framework in which CPAs operate allows them to interpret the tax law more to the taxpayer's benefit than can unregulated preparers. Empirical results support this hypothesis.

The remainder of this paper is divided as follows. First, the economic theory of regulation and the regulatory environment in which tax preparers operate is described. This is followed by development of the research hypothesis. The next section describes the sample and the design of the study. Results are then presented and the last section discusses limitations of the research and presents our conclusions.

THE ECONOMIC THEORY OF REGULATION AND PROFESSIONAL TAX PRACTICE

The economic theory of regulation which has been popularly referred to as "capture" or "interest group" theory asserts that regulation exists to benefit the regulated parties. Initially suggested by political scientists Bentley [1908] and Truman [1951], Stigler [1971] articulated the economic theory of regulation by examining the supply and demand for regulation. Stigler argued that industries which commanded sufficiently large political power and cohesiveness would endeavor to utilize the powers of the state to increase the industry's profitability. Stigler's model has been elaborated by Peltzman [1976].

In the area of tax practice, CPAs fall in the regulated group of tax preparers and are able legally to offer clients a broader range of services than can preparers without professional certification. As discussed below, regulation of these services allows these practitioners to interpret the law more to the benefit of the taxpayer, further increasing the value of the regulated practitioner's services to the client and, thus, the total industry profitability.

While no license is required to prepare tax returns, licensing exists in the form of the regulations of Circular 230 for some practitioners [United States Department of Treasury, 1985]. Circular 230 grants CPAs, lawyers, and enrolled agents the right to practice before the IRS. Practice before the IRS means that an individual may represent a client in all matters related to the IRS. The right is valuable because it enables the practitioner to represent the client's interest in obtaining rulings, negotiating settlements in disputes, achieving abatement of penalties, and settling other conflicts with the IRS. The IRS has the authority to prohibit practice before the IRS by individuals they deem to have violated Circular 230.

Circular 230 historically incorporated the standard of the accounting profession which states that the preparer need not disclose a position contrary to a Treasury Department or IRS interpretation as long as there is reasonable support for the position [AICPA, 1987]. IRS Regulation Section 1.6661-3(a)(2) defines reasonable support to be a position that is "arguable but fairly unlikely to prevail in court." The interpretive latitude of this standard has been a major source of contention between the IRS and tax preparers in recent years because it enabled tax practitioners to aid their clients in playing the audit lottery [Graetz, 1987]. The reasonable basis standard effectively immunized a preparer and the client from penalties in all but extreme cases.[1]

[1] For example, in public tax shelter offerings attorneys and CPAs have been hired routinely to issue tax opinion

At the request of the IRS, in 1982 Congress enacted Section 6661 to effectively override the reasonable basis standard and require the higher tax return reporting standard of "substantial authority." This standard, and penalties for noncompliance are imposed on the taxpayer, not the preparer.[2] Recently, the Treasury has attempted to impose this same standard on practitioners through its Circular 230 authority [Shapiro, 1987]. New proposed rules provide that preparers and their firms could be subject to the loss of the right to practice if a return signed by the preparer is assessed a Section 6661 penalty.

The accounting and legal professions have vigorously protested the proposed standard, charging that the proposal infringes on the preparer's role as advocate for the client in interpreting the "legitimate controversies" in the tax law [Podolin, 1987]. The AICPA has proposed an alternative which states that a practitioner may advise or recommend a position for which the practitioner has "a good faith belief that the position has a realistic possibility of being sustained administratively or judicially on its merits if challenged" [AICPA, 1987]. The risk of violating this standard is substantially lower than the proposed IRS standard because it is difficult for the IRS to challenge a tax preparer's beliefs.

HYPOTHESIS DEVELOPMENT

For preparers who have the right to represent their clients before the IRS, the advantage of recommending pro-taxpayer positions in ambiguous situations is obvious. The client has lower initial taxes and, if the item is questioned, the preparer can represent the client and in many cases save the client from penalties [IRS, 1987, pp. 173–175]. Even if more taxes are required, they are no more than they would have been had the more conservative position been taken initially.

Practitioners governed by Circular 230 are better able to successfully argue pro-taxpayer positions than other practitioners for two reasons. First, the ability to represent the client in all IRS proceedings allows the practitioner to develop more complete knowledge of the IRS agenda and initiatives. This knowledge of the unwritten rules of administering the tax law permits these practitioners to assess more accurately the probabilities of challenge on particular issues and to advise their clients accordingly. Because of frequent interactions with the IRS, these practitioners become "repeat players" and have opportunities to develop informal working relations with IRS personnel which can be used to facilitate the resolution of issues through bargaining to the client's benefit. Galanter [1974] notes that when repeat players and the government meet in adversarial relations, the expectation is that mutually satisfactory outcomes will be achieved through bargaining and an informal system of controls.

Second, the regulations which govern practice before the IRS serve to provide some protection from penalties both to the client and to the practitioner. Even if a position is denied upon audit, the probability that a penalty will be assessed is relatively small compared to the probability for unregulated preparers so long as the standards of Circular 230 have been followed. That is, if the practitioner

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letters regarding the reasonable basis of the tax status of an investment offering in order to provide a form of "fraud insurance" against the imposition of a penalty to investors if the position were denied upon audit [Graetz and Wilde, 1985].

[2] Section 6661 provides that a taxpayer who takes a tax return position which is not supported by substantial authority and fails to disclose this is subject to a 25 percent "no-fault" penalty.

can effectively argue that there was reasonable support or substantial authority for a position, penalties will not be assessed. Even after the assertion of a penalty, these practitioners tend to be more successful in obtaining abatements both for their clients and for themselves [IRS, 1987, pp. 75 and 173–175].

In contrast, preparers who are not authorized to practice before the IRS are placed in a difficult position if their clients are audited. These clients must either go to the audit themselves and justify a position which they may not be prepared to argue, take the preparer along as an adviser, or hire a regulated tax practitioner as a representative. In addition, because unlicensed preparers lack experience with IRS agents, they may find it more difficult to assess the risk to the client of audit associated with claiming alternative positions. Hence, we expect that unlicensed preparers are more likely to recommend positions which they perceive the IRS will readily accept.

The combination of the bargaining advantage obtained in representing clients before the IRS with the regulatory protection from penalties offered through the standards of the profession and Circular 230 leads to the hypothesis that CPAs will be more likely to recommend pro-taxpayer positions than will practitioners not governed by Circular 230. Formally, the research hypothesis is:

> Ha: Judgments of tax practitioners who are CPAs are more pro-taxpayer than the judgments of non-regulated preparers in ambiguous situations.

SAMPLE AND EXPERIMENTAL DESIGN

The hypothesis was tested by administering a set of five ambiguous tax cases to a sample of tax practitioners attending continuing education programs. They represent a wide range of geographical and professional backgrounds.[3] The subjects were divided into three broad categories. These were (1) CPAs employed by Big Eight CPA firms, (2) CPAs employed by other CPA firms, and (3) unenrolled tax practitioners. The initial sample consisted of 228 practitioners. However, because some of the respondents either failed to complete the instrument or did not meet our selection criteria, the final analysis was conducted on 168 usable responses (69 Big Eight, 50 non-Big Eight, and 49 unenrolled practitioners).[4]

All five cases related to tax questions for which no clear-cut answer was evident. The case descriptions included the major relevant authorities pertaining to each case. This provided some degree of control for participants' levels of prior knowledge regarding the subject in order to assure that participants' answers were not based simply on prior experience. Each subject responded to all five cases presented in a random order. Subjects were asked to interpret the tax status of each case on a six-point scale ranging from a "one" for the most conservative (pro-government) to a "six" for most

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[3] The classes were continuing education sessions on various topics including corporate tax, oil and gas accounting, and tax planning. Six different Big Eight firms provided subjects as well. The instruments were administered at the firm offices. We limited our sample to tax department individuals with a minimum of two years of experience. The states represented were Arizona, Oklahoma, Colorado, and Texas.

[4] It is possible to view professional status from two perspectives. One is the professional credential held. The other is the type of firm by which the individual is employed. That is, it is possible for a non-CPA to work for a CPA firm, or for a CPA to be employed by a law firm or a corporation. Because we could not differentiate between the impact of firm policy versus the professional credentials in terms of the theoretical impact of regulatory policy, we restricted the sample to exclude non-CPAs employed by CPA firms and the converse. We also excluded nine enrolled agents from our sample.

TABLE 1

CELL MEANS FOR SUBJECT RESPONSES AND TESTS OF DIFFERENCES IN PREPARER STATUS BY CASE ($n=168$)

	Cell Means					
Case[1]	*CPA*	*Non-CPA*	*Difference*	t-*statistic*[2]	*Step-down* F-*statistic*	p>F
1	4.81	3.83	.98**	3.72	13.83	.0003
2	4.72	3.85	.87**	3.10	6.07	.0148
3	3.89	3.44	.45*	1.54	1.19	.2500
5	3.43	3.61	−.18	.63	.33	.5400
4	3.50	3.67	−.17	.54	.23	.7500

* Significant at the .10 level (one-tailed test).

** Significant at the .05 level (one-tailed test).

[1] Cases are listed in order of their contribution to the overall model (e.g., the magnitude of their sum-of-squares due to treatment).

[2] The difference between the significance levels of the *t*-statistics and the *F*-statistics is that the *t*-statistics are based on univariate tests of differences between means, while the step-down *F*-statistics measure the incremental contribution of each variable to the model.

liberal (pro-taxpayer). Two of the cases involved a question of deductibility, one involved classification of income, and two involved recognition of income. An example instrument is included in an appendix.

RESULTS

Because all five cases were answered by all subjects, the responses are appropriately viewed as a single vector variable. The independent variable, the subject's professional status, is a class variable. Hence, the appropriate statistical analysis is multivariate analysis of variance (MANOVA). Using Wilke's criterion the MANOVA test resulted in an overall F of 4.86, significant at $\alpha=.0004$. To determine which cases were contributing to the results, the analyses of variance for the individual cases were examined. In a study which is appropriately a MANOVA design, the use of individual ANOVAs can result in misspecification of the Type I error because the individual responses are not independent. Hence, a method which accounts for the dependence across measures is more appropriate [Stevens, 1973]. An appropriate method is the use of step-down F-tests that determine the incremental contribution to the model of each dependent variable as it is added to the model. The step-down analysis is analogous to a series of analyses of covariances, with the dependent variables entered successively into the model as covariates in the analysis. The computational procedures are discussed in Stevens [1973] and Redinger [1977].[5] Absent a theoretical rationale for a specific ordering, the variables should be entered in the model in descending order based on the sum-of-squares due to treatments for each variable [Redinger, 1977].

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[5] The extent to which step-down results differ from individual ANOVAs depends upon the extent to which the dependent variables are correlated. In this study the highest degree of correlation was .15 ($\alpha=.05$) between cases 1 and 2. The individual analyses of variance yielded similar results to the step-down tests: In both cases, only cases 1 and 2 were significant.

Table 1 presents the cell means and the results from the step-down *F*-tests.[6]

The results of the main effect for status are consistent with the economic theory prediction. That is, CPAs were more pro-taxpayer in their interpretations than were unregulated preparers.[7] The results of the individual tests revealed that the significant differences are concentrated primarily in the deduction cases. The income classification case was marginally significant ($\alpha = .06$ for a one-tailed test) while the two cases which were based on income recognition were not significant. This result is perhaps not surprising when we consider that the IRS third-party reporting requirements regarding income imply that a higher degree of judgment will be required for deduction or income classification cases than for income recognition.[8]

An Alternative Test

In addition to the analysis of variance, we performed an alternate test of the significance of the professional status variable. To determine if the difference between means reflects a difference in the preparers' basic judgments (as opposed to the degree of certainty), the response variables were coded as follows. Responses of 1–3 were coded as "0," indicating that the judgment was pro-government (not deductible or income). Responses of 4–6 were coded "1" indicating that the judgment was pro-taxpayer (deductible or not income). We then conducted a chi-square test of independence on the differences between CPA and unregulated tax preparers (see Goodman and Kruskal [1979, pp. 739–740] for a discussion of this procedure). The results of the classification are presented in Table 2. The difference in the degree to which preparers are pro-taxpayer differs markedly between CPA and unregulated preparers (67 percent and 54 percent, respectively). The chi-square statistic was significant at the $\alpha = .0001$ level. This finding is consistent with the opinions expressed in *Survey of Tax Practitioners and Advisers* in which 72 percent of CPAs and 56 percent of unenrolled preparers expressed the opinion that all matters with reasonable doubt should be resolved in favor of the client [IRS, 1987, p. 55].

If these differences persist into actual return preparation and advice, they lead to dramatic differences in taxes paid. Such systematic differences are important because of the distributional consequences to taxpayers. That is, such a finding leads to the conclusion that taxpayers who use different types of preparers are governed by somewhat different rules of taxation.

LIMITATIONS AND CONCLUSIONS

There are two limitations of this research of which we are aware. First, as is true in most experimental type research, the subjects' choices were made in hypothetical decision contexts. We did not ask subjects to decide what they would recommend. Rather, we asked for their assessments of the tax treatment in situations where the law is ambiguous. The

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[6] The impact of three covariates was considered in the analysis. These were (1) the gender of the respondents, (2) the number of years of tax preparation experience, and (3) whether the preparer had encountered a similar case in practice. None of the covariates had a significant effect and were dropped from the model.

[7] We also ran the MANOVA using three groups for status, Big Eight CPA, non-Big Eight CPA, and non-CPA preparers. Our results are essentially the same as those in Table 1 and are not reported here. They also revealed that the difference between Big Eight and non-Big Eight preparers was not significantly different.

[8] Code Section 6041 prescribes explicit and comprehensive reporting requirements for persons engaged in a trade or business who make payments to others for salaries, rents, and other compensation. In contrast, items deductible to a taxpayer are subject to third-party reporting only in very narrow circumstances.

Table 2

Table of Status by Recommendation

Recommendation = 0 if response = 1–3
Recommendation = 1 if response = 4–6

	Recommendation		
Status	*0 (pro-government)*	*1 (pro-taxpayer)*	*Total*
CPA firm			
Number	195	400	595
Percentage	32.77	67.23	70.83
Non-CPA			
Number	112	133	245
Percentage	45.71	54.29	29.17
Total	307	533	840
	36.55	63.45	100.00

$\chi^2_{(1)} = 12.533$ (significant at the .0001 level).

question of whether the subjects' taxability assessments would be similar in practice is an empirical question which is not readily answerable given the type of data that can be obtained from the IRS. We expect that there is a strong positive relation between a practitioner's assessments of deductibility or taxability and the actual decisions made in practice. Other research indicates a predictive relation between attitudes and behavior [Fishbein and Ajzen, 1975].

Second, we did not consider how CPA and nonregulated preparers may differ in other aspects besides the governing regulations, and what impact this would be expected to have on the respondents' judgments. There are two areas where CPAs likely differ from nonregulated practitioners. The first is in training and education. CPAs are more highly trained and typically better educated than nonregulated preparers because of professional certification requirements. This suggests that they would be expected to possess greater knowledge of the tax law. However, there is no reason to assume that this training and knowledge would convert into systematically more pro-taxpayer behavior. That is, one might argue that because CPAs are better trained, they should know the tax law better and recommend positions that are more in accordance with the IRS interpretation of the tax laws. The counterargument is that CPAs' greater training and experience allows them to take and justify more pro-taxpayer positions. This argument is consistent with economic theory, because it is the ability to justify the positions taken and reduce penalties through the IRS representation process that gives CPAs a competitive advantage in attracting clients interested in minimizing their tax burdens.

A second possible confounding effect is the impact of clientele. CPAs typically represent wealthier clients with more complex returns than non-CPAs [IRS, 1987; Yankelovich et al., 1984]. Small, independent CPA firms typically deal with less wealthy clients than do Big Eight firms. If the clientele effect or firm size materially affected the results, significant differences should be found between Big Eight and non-Big Eight CPAs. This was not the case. Moreover, a clientele effect between regulated and unregulated preparers is consistent with the theory. Individuals interested in taking a relatively aggressive stance within the tax system are more likely to seek out those preparers who have demonstrated a willingness to decide ambiguous issues in the taxpayer's favor and who are able to effectively defend those positions if challenged [Galanter, 1974].

This study has presented evidence of differences in the degree of pro-taxpayer behavior exhibited by CPA and unregulated practitioners as they made judgments concerning ambiguous tax situations. CPA preparers were found to be more pro-taxpayer in their judgments than unregulated practitioners. The economic theory of regulation would predict such a result for practitioners permitted to offer enhanced taxpayer services through the right to practice before the IRS. Through practice before the IRS, CPAs and their clients are afforded a degree of protection from penalties as well as negotiating power not afforded to preparers not authorized to practice before the IRS. The current attempts to reduce the latitude of the practitioner in advising tax return positions signal a move by the governmental authorities to reduce the benefits of regulation accruing to regulated tax practitioners. As the theory of regulation would predict, this move is being vigorously challenged by the accounting profession.

APPENDIX

CASES

(Numbers are for expositional purposes only.
Cases given to respondents were not numbered.)

CASE 1

Taxpayer A has been a client for several years. He has asked you to prepare his tax return again this year. Included in A's tax information is the following:

Taxpayer A's wife has a serious heart condition. The doctor advised her to swim daily after she had open heart surgery. There was no neighborhood pool so that taxpayer built a modest indoor pool for the lowest bid he could obtain to ensure his wife's access to a swimming pool. Before and after building the pool, he requested real estate appraisals. The fair market value did not increase according to the appraisal since the value before the improvement was already higher than any perceived buyer in that area would be willing to pay.

Authorities

Section 213(d)(1)(A) defines "medical care" as "amounts paid for the diagnosis, cure, mitigation, treatment, or prevention of disease, or for the purpose of affecting any structure or function of the body." Regulation 1.213-1(e)(iii) states that qualifying capital expenditures are deductible to the extent that the expenditure exceeds the increase in the value of the related property, if the particular expenditure is directly related to medical care.

Numerous cases support the taxpayer's deduction of medically related capital expenditures to a personal residence, to the extent the expenditure exceeds the increase in property value. The IRS in Rev. Rul. 83-33 ruled that the cost of constructing a "lap" swimming pool to treat severe osteoarthritis is deductible to the extent the cost exceeds the property's increase in value. In *Haines* (TC, 1982) the taxpayer was denied a deduction for the cost of a swimming pool built at his home. The pool was a convenience, not a necessity. There was no special equipment and use was limited to half the year. *Ferris* (CA-7, 1978) involved a swimming pool that was judged to be extravagant for medical needs. The court held that if a facility is more lavish than necessary for medical purposes, the additional cost incurred is not deductible as a medical expense.

Please circle the category below that best represents your evaluation of the deductibility of the medical expense in preparing the return for your client.

Definitely Not Deductible	Probably Not Deductible	Unsure— So Not Deductible	Unsure— So Deductible	Probably Deductible	Definitely Deductible

CASE 2

Taxpayer B has been a client for several years. He has asked you to prepare his tax return again this year. Included in B's tax information is the following:

Taxpayer B has been a practicing CPA specializing in tax for two years. Although his firm would not agree to pay his expenses because they offered their own training program, he decided to obtain a master's degree in taxation to improve his skills in his job. Taxpayer B has no intention of pursuing any career other than one in public accounting. However, the combination of the CPA certificate and master's degree in taxation qualifies Taxpayer B to hold a position as a professor at many colleges and universities.

Authorities

Regulation Section 1.162-5(b) (filed in 1967) allows a deduction of educational expenses as ordinary and necessary business expenses if the education maintains or improves skills required in the individual's employment, as long as the education is not fulfilling the minimal educational requirements of the taxpayer's job or qualifying the taxpayer for a new trade or business. The regulations give examples denying a deduction for the cost of obtaining a law degree even though the taxpayer intends to continue his nonlegal profession and not to practice law. The reason for the holding is that the individual qualified for a new trade or business.

Numerous cases deny a deduction for educational expenses related to the CPA exam (*Glenn*, TX, 1974; *Archie*, TCM, 1978; *Cooper*, TCM, 1979; and *Sevier*, TCM, 1977) and for expenses related to a law degree (*Sharon*, TC, 1976, aff'd CA-9, 1978, cert. den. 1979) because the CPA certificate or law degree qualified the taxpayer for a new trade or business. In all cases, it was determined to be irrelevant that the taxpayer did not intend to change employment, but merely sought to improve skills in present employment.

A deduction was allowed a CPA who took law school courses to improve his skills as a CPA, did not intend to practice law, and had not practiced law at the time of the trial (*Berry*, TCM, 1971). A lawyer was allowed to deduct the cost of a graduate legal degree; he was practicing law before and during graduate school (*Rueh*).

Please circle the category below that best represents your evaluation of the deductibility of the educational expense in preparing the return for your client.

Definitely Not Deductible	Probably Not Deductible	Unsure— So Not Deductible	Unsure— So Deductible	Probably Deductible	Definitely Deductible

CASE 3

Taxpayer C has been a client for several years. She has asked you to prepare her tax return again this year. Included in C's tax information is the following:

Taxpayer C inherited her father's home in 1982. She rented it to a friend who moved in immediately after C's father's death. The friend moved out in 1984 and, shortly thereafter, C sold the house at a loss. C had been involved in no other asset transactions in 1984 or in any of the previous two years.

Authorities

Section 1231 allows taxpayers selling "trade or business" property to characterize net gains as capital and net losses as ordinary, assuming the "look back" rules do not apply. If the property is not "trade or business" property, their transaction will generate capital gain or loss.

Numerous cases have held that the rental of even a single parcel of improved real property constitutes a trade or business of the taxpayer (*Hazard*, TC, 1946, acq.; *Schwarz*, TC, 1955, acq.; *Jamison*, TC, 1974, acq.; *Noble*, TC, 1946, acq.; and *Lagreide*, TC, 1959). In 1980, the IRS issued a private letter ruling adopting the Tax Court's position that mere rental of even a single piece of improved real estate constitutes a trade or business.

Three cases (*Union National Bank of Troy*, N.D. NY, 1961; *Grier*, D. Conn., 1954, aff'd CA-2, 1955; and *Bauer*, Ct. Cl., 1958) involving the taxpayer's sale of his or her sole piece of improved rental property characterized the gain as capital. These cases stressed the importance of a careful review of facts and circumstances, particularly the taxpayer's involvement with the rental activity. *Grier* involved facts virtually identical to those of Taxpayer C. All cases that characterized the loss as capital involved taxpayers who had deducted the loss as capital and carried over the loss. The loss year was barred by the Statute of Limitations.

In 1983, the IRS issued a private letter ruling which holds that property will not be classified as trade or business property if the owner engages only in passive activities related to the property. A facts and circumstances test must be applied to determine trade or business status. The ruling relied on *Curphey*, TC, 1980. *Curphey* involved an M.D. who owned and managed several rental properties and sought to deduct home office expenses under Section 280A. The court found that *Curphey* met the level of activity standard but stated: "ownership and management of rental properties does not *as a matter of law* constitute a trade or business."

Please circle the category below that best represents your evaluation of the classification of the loss in preparing a return for your client.

Definitely Capital Loss	Probably Capital Loss	Unsure— So Capital Loss	Unsure— So 1231 Loss	Probably 1231 Loss	Definitely 1231 Loss

CALCU

Case 4

Taxpayer D has been a client for several years. She has asked you to prepare her tax return again this year. Included in D's tax information is the following:

Taxpayer D won a contest sponsored by her employer. The contest was for employees only. The prize was an annuity payable to any person selected by the taxpayer under the age of 15. Taxpayer D was 32 years old and named her 10-year-old niece as beneficiary.

Authorities

Section 61 provides that gross income means all income from whatever source derived. Section 74 provides that gross income includes amounts received as prizes and awards unless the award is in recognition of religious, charitable, scientific, educational, artistic, or civic achievement.

Rev. Rul. 58-127 involved a contest in which a parent submitted an entry in an essay contest. The contest stipulated that the entrant was required to name a recipient under a specified age to receive the prize. The IRS held the parent taxable on the prize because "the power to dispose of income is equivalent to ownership of it" (*Helvering vs. Horst*, Sup. Ct., 1940).

Teschner (TC, 1962, gov't. appeal dismissed nolle pros. CA-7, 1963, nonacq. 1964) duplicated the facts of Rev. Rul. 58-127. Taxpayer Teschner entered a contest by submitting an essay on the importance of education. The contest was open only to nonemployees of the sponsors. The prize was an annuity payable only to persons under a specified age. Taxpayers over that age were required to specify a qualifying recipient. Teschner named his 7-year-old daughter in his submission. The court held that there was no assignment of income from Teschner to his daughter; even though taxpayer's efforts generated the income, he had no right to enjoy or receive the income, nor was the payment in discharge of an obligation of the taxpayer. The court disagreed with Rev. Rul. 58-127 because "the power of disposition assumes possession or the right of possession. To dispose of is to part with. Where there is neither possession nor the right to possession, there can be no disposition."

In *Armentrout*, TC, 1976, aff'd CA-7, 1978, a trust was established by taxpayer's employer to pay educational expenses of employee's children. The employee's children could forfeit benefits under the plan in certain circumstances. Such forfeiture would result in increased benefits to other children or reduction in the employer's future contributions. The court held the payments to the trust taxable as compensation income to the parents. *Grams*, TCM, 1980, reached the same conclusion as *Armentrout*.

Please circle the category below that best represents your evaluation of the includability of the income in preparing your client's return.

Definitely Income	Probably Income	Unsure—So Income	Unsure—So Not Income	Probably Not Income	Definitely Not Income

Case 5

Taxpayer E has been a client for several years. She has asked you to prepare her tax return again this year. Included in E's tax information is the following:

Taxpayer E recovered damages from her employer in a settlement agreement because of job discrimination. The damages were designated by the employer as payment for back pay. However, E claimed that the damages were greater than the amount of pay differential and that part of the payment was for compensation for personal injury, i.e., the psychic, mental, and emotional injury suffered as a consequence of the discrimination. Therefore, E claimed that part of the damages should be excluded from her gross income by Section 104.

Authorities

Section 104(a)(2) excludes from gross income "the amount of any damages received (whether by suit or agreement) on account of personal injuries." Regulation Section 1.104-1(c) defines damages as an amount received on account of personal injuries as a result of a tort action either through a legal suit or a settlement agreement.

Cases dealing with job discrimination under the Civil Rights Act of 1964 have generally held that the payments are taxable because they represent back pay, not payment for personal injury (*Willie B. Hodge*, TC, 1971; *Watkins*, Ct. Cl., 1980; and *Sophia M. Coats*, CA-9, 1980). A 1982 private letter ruling denied the exclusion for damages designated in the settlement agreement to be for pain and suffering from job dismissal. A recent case, however (*Sweet vs. General Tire and Rubber*, ND Ohio, 1982), segregated the damages received in a job discrimination suit and held that part were for personal injury and, therefore, were not taxable.

Please circle the category below that best represents your evaluation of the excludability of the damages in preparing your client's return.

Definitely Income	Probably Income	Unsure— So Income	Unsure— So Not Income	Probably Not Income	Definitely Not Income

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Firm-Specific Responsiveness to Input Price Changes and the Incremental Information in Current Cost Income

William Hopwood and Thomas Schaefer

ABSTRACT: Using security return cross-sectional association tests, empirical studies to date have yet to show significant incremental information in total current cost income (including all holding gains) beyond that provided by historical cost income. The theoretical work of Revsine [1973] and others, however, indicates that positive unexpected holding gain information may be good news for some firms but not for others depending on the firms' ability to respond to cost increases. Therefore, if firms differ in their responses to cost changes, cross-sectional studies may be unable to detect an incremental informational effect for total current cost income. The present study provides evidence which supports the existence of such differential responses across firms. A sample of firms reporting SFAS No. 33 data is partitioned based upon past associations of operating income with input cost changes. This association provides an empirical measure of firms' relative abilities to adjust operating flows in response to input cost changes. Statistical tests indicate that such a partition yields significant differences in how equity returns and current cost income are associated.

THE recent availability of Statement of Financial Accounting Standards (SFAS) No. 33 [Financial Accounting Standards Board, 1979] information on both current cost income from continuing operations and holding gains has allowed for empirical analyses of the information in these disclosures in the market for firms' equity securities. Studies by Beaver and Landsman [1983], Bublitz et al., [1985], Beaver and Ryan [1985], and Murdoch [1986] have produced mixed results in support of the hypothesis that current cost information yields an income number whose incremental effects are significant in terms of explaining security returns. These studies rely on cross-sectional regressions in testing for incremental information primarily due to the relatively few years (four to

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five) of current cost income data availability. Such cross-sectional analyses, however, assume that similar current cost income numbers have similar effects on security prices for the entire sample of firms.

An important aspect of these studies is that in no case did the research design allow for the possibility that holding gains component of current cost income might be good news for some firms and bad news for others. Revsine [1973, p. 103] noted that a holding gain may indicate an increase in future operating flows for one firm, but a decrease or no change for another. For example, consider an unexpected increase in the current cost of inventory. In one sense, the firm has benefited from purchasing the inventory before the price rise. However, unless there is a quick and proportionate sales reponse to the cost increase, it is possible that net future cash flows will decline due to the increased costs of replenishing inventory stocks. In general, the sales reponse will differ across firms and will depend on a given company's ability to pass on cost increases to the consumer which, in turn, depends upon the company's ability to vary its product mix, as well as the elasticities and cross-elasticities of the company's related products. As a result, a positive association of total current cost income with equity returns would be expected for some firms and, *ceteris paribus*, a negative (or zero) association for others [Cowling and Waterson, 1976]. Therefore, a cross-sectional regression approach to assess the information in unexpected current cost income will not be useful unless firms respond similarly to input price changes.[1]

The purpose of the present research is to investigate whether there are differential incremental information effects for total current cost income numbers that depend on firm-specific responsiveness to input price changes. We do not attempt to resolve the issue of the incremental usefulness of SFAS No. 33 data to the market. However, we provide evidence on an issue that affects the appropriateness of the methods that have been used in virtually all previous market-based studies relating to the incremental information in total current cost income.

The present study adopts the same basic approach used in previous studies but partitions the sample based upon firm-specific responsiveness to cost changes. The grouping is accomplished using a response measure which cross-sectionally stratifies firms as to their relative abilities to adjust operating income during periods of price changes. The total current cost and historical cost income numbers are then jointly associated with security return measures within each partitioned subgroup using ordinary least squares regression. Statistical tests then compare current cost income coefficients across the subgroups' regressions. These tests indicate that the measure of association between the current cost income variable and security returns significantly differs across subgroups. Further statistical analyses are then presented concerning the incremental informational effects of the SFAS No. 33 data within each subgroup. These subgroup tests provide evidence of statistically significant informational effects for the current cost income variable that are not found when the subgroups are combined into a single group.

The remainder of the paper is organized as follows. The first section provides background information concerning holding gains and income determination. The next section describes the data, the method used for grouping firms, and the models used in assessing information effects. The results of the analysis are then presented followed by a discussion of the conclusions and limitations.

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[1] See Watts and Zimmerman [1980], Beaver et al. [1980], and Gheyara and Boatsman [1980] for a further discussion of this issue.

HOLDING GAINS AND INCOME DETERMINATION

Typically, current cost income measures are expressed in terms of two components. First, a current operating profit component represents the difference between sales and the current cost of goods sold. Second, a holding gain or loss component represents the change in the current costs of assets, both realized and unrealized, that occurred during the reporting period. Edwards and Bell [1961, p. 115] referred to the unrealized component of the holding gain as "realizable cost savings" resulting from the purchase of an asset whose price subsequently increased. By including holding gains and losses in total current cost income, no differential treatment is given to income arising from the production process and income arising from changes in the prices of the firm's assets.

Revsine [1973, p. 92] provided a theoretical justification for the income treatment of holding gains and losses. Revsine argued that, for some assets, market value (current replacement cost) is determined by discounting the future operating flows expected to be generated from asset use. Therefore, increases or decreases in the market value of an asset represent implicit changes in the asset's operating flow expectation. To the extent that this occurs, changes in market value qualify for income treatment due to the corresponding change in earning power. Revsine referred to this relation as the covariance between asset prices and operating flow potential.

Although Revsine asserted that a positive covariance between asset prices and operating flow potential probably was descriptive in the aggregate, he recognized that there was no necessity for such a positive covariance for any particular firm. As asset prices change, operating flows could increase, decrease, or remain constant. Therefore, the inclusion of holding gains in total current cost income may make the assessment of future operating flows more difficult. Although Edwards and Bell would recognize a cost savings from holding an asset whose price rises as a holding gain, Revsine [1973] indicates:

> From one perspective it might actually appear that the firm's position has *worsened* after the price rise. That is, all subsequent replacements of the asset after the price rise will necessitate a greater outflow than similar replacements before the price rise [p. 88].

Thus, firms may differ in their ability to pass along price increases to their particular output markets. If a firm is successful in increasing operating flows when confronted with input price increases, its holding gains may be indicative of increased future cash flows. On the other hand, firms who are not so successful in responding to input cost increases may find their savings from timely purchasing offset by decreased future cash flows. Therefore, any analysis of total current cost income must control for these firm differences. In the next section we describe a method to incorporate such a control.

METHOD

Sample firms (described below) were initially classified into high and low "cost response" groups on the basis of their operating income responses to changes in specific input prices experienced by the firm. Both historical cost income and replacement cost income measures (including the holding gain component) were then computed. Next, traditional capital market informational effects regression (association) models (i.e., similar to those used by Beaver and Landsman [1983]) were estimated separately for the high and low cost response groups. Tests were then conducted for equality of these two regression models and for the significance of their respective coefficients.

Data

In order to categorize firms on the basis of their operating flow responses to input price changes, specific input price indices were gathered directly from the U.S. Department of Commerce. This input price information was available for three categories: materials (including energy), labor, and plant and equipment. Each index series was compiled by the Department of Commerce by 2-digit Standard Industrial Classification (SIC) codes for industrial firms (20 through 39 SIC codes). Fourteen years of these input price indices were available from 1967 through 1980.[2]

Three computer databases were then used to obtain the income and security return data needed for the analysis. Version IV of the SFAS No. 33 Data Bank provided the current cost operating income numbers as well as the holding gain or loss data. The COMPUSTAT file was used to gather the historical earnings data, and the CRSP tapes were used in computing the equity security return metrics. Firms for which complete data were not available on the data tapes were excluded from the analyses. Finally, firms were required to have December 31 reporting year ends. This requirement allowed the alignment of CRSP, COMPUSTAT, and SFAS No. 33 data with the Department of Commerce price indices. Because the research design required two consecutive years of data for each year studied, analyses were performed for 1981, 1982, and 1983.[3]

The CRSP, COMPUSTAT, and SFAS No. 33 data constraints, requiring the current period's income and security returns sufficient to estimate the market model, provided 402, 402, and 395 firms for analysis in 1981, 1982, and 1983 respectively. The additional constraint that limited the sample to those industries for which the cost index data were available plus the constraint requiring 16 years of operating income for estimating equation (1) further reduced the sample to 93, 97, and 90 firms in each of the three years.

Grouping firms by specific price change sensitivity. SIC codes were used to match each firm with an industry-wide set of input price indices. Industry indices, as opposed to an econony-wide index, were chosen to better approximate the price changes facing the particular firm. Sunder and Waymire [1983] and Shriver [1986], using PPI index systems, found that the marginal gain in accuracy of valuation declines sharply as the number and specificity of price indices used for valuation increase. Also, Lim and Sunder [1985] present arguments for using aggregated price indices for estimating current costs which shows that accuracy of valuation may be increased as compared to firm-specific indices. Therefore, industry level price indices are used in this study to estimate the effect of input cost changes on individual firms.

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[2] These indices differ from the Producer Price Index (PPI) System in that they represent changes in input costs whereas the PPI System represents changes in the output prices of the products of various industries. All indices available were used.

[3] Another year, 1980, potentially could have been added to the analysis, however, due to the voluntary nature of the 1979 SFAS No. 33 disclosures, too few firms were available after application of the other data requirements for analyses to be performed in 1980.

The price index information was used to categorize firms on the basis of the responses of their historical cost operating income to price changes. Measures of these responses were based on the estimates of the coefficients of a regression model with unexpected cost (input price) changes as the independent variables and unexpected operating profits (defined below) as the dependent variable.[4] Unexpected numbers, as opposed to levels, were used because the categorization model hypothesized differential market reactions to departures from expectations, rather than absolute levels. Furthermore, it has been shown that the use of the levels of upward trending variables in regression analysis produces inefficient estimation and suboptimal forecasts [Granger and Newbold, 1974, 1977; Yule, 1926; and Vandaele, 1983].[5]

The computation of unexpected operating income and costs involves the difference $A-E[A]$, where A is either the reported cost or operating profit and $E[A]$ is the expected cost or operating profit. Since $E[A]$ is unobserved, it must be determined from an expectation model. For earnings, one commonly used model is the random walk following the form:

$$A_t = A_{t-1} + a_t,$$

where a_t is a random error term that represents the unexpected income.[6] Note that this implies that the unexpected earnings is the first difference in A_t. In such a model the unexpected earnings is simply the change in earnings. Similarly, a random walk expectation might be employed to measure unexpected input cost changes. However, a model that hypothesizes no expected change in a firm's costs does not seem plausible over the time period studied when there were very strong increases in the general price level.

Specifically, application of the first difference model to the cost series resulted in all positive values for unexpected inflation. Therefore, such a model produces a non-random error and does not adequately detrend the series. More plausible is a model that assumes that changes in costs from year to year are constant. Specifically, the second difference model:

$$a_t = (A_t - A_{t-1}) - (A_{t-1} - A_{t-2}).$$

Analysis indicated that the errors from this model were random in sign. Therefore, for each firm, the following model was estimated over the 14-year period (prior to those years used for capital market association tests) of data availability.

$$\Delta y_{it} = \alpha_i + \gamma_{i1}(\theta m_{dt}) + \gamma_{i2}(\theta l_{dt}) + \gamma_{i3}(\theta p_{dt}) + \epsilon_{it} \qquad (1)$$

where

y_{it} = operating income per share for firm i in year t,
m_{dt} = cost of materials (including energy) index for industry d (firm i's industry) in year t,
l_{dt} = cost of labor index for industry d in year t,
p_{dt} = cost of plant and equipment index for industry d in year t,
Δ = first difference operator,

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[4] Historical (as opposed to current cost) income was used because of its availability for a sufficient number of years to estimate the coefficients in the regression model.

[5] Differencing serves to detrend the regression variables. Vandaele [1983, pp. 261–263] in discussing transfer-functions and their special case, multiple regression models, notes that "...there is no need to use the same difference operator for each variable."

[6] Albrecht et al. [1977] did an extensive investigation of the time-series properties of annual earnings, and found that individually identified time-series models did not forecast more accurately than did the random walk model.

θ=second difference operator,
α_i=intercept term for firm i,
ϵ_{it}=error term for firm i in year t; $E(\epsilon)=0$, and
γ_i=estimates of regression coefficients for firm i.

Equation (1) models the response of operating income changes to changes in input costs. The model incorporates the available industry wide observations of input price changes as provided by the U.S. Department of Commerce. Because three input factors (materials, labor, and plant and equipment) were simultaneously incorporated, the resulting estimate is the overall responsiveness of operating income to changes in a broad cross-section of input costs.

Historical cost operating income was chosen as the dependent variable in equation (1) for several reasons. First, to assess the ability to pass on cost increases, a measure which contained both revenues and cost elements was necessary. Because of our inability to gather industry specific information on other types of costs, we concentrated on operating costs. Given input price data availability, operating income met our need for measuring the differential between revenues and primary costs. Second, operating income was available for the estimation period.

Cost response measures were computed for each firm in the sample by summing the coefficients from price change model (equation (1)) as follows:

$$CR=\sum_{k=1}^{3}\eta_k \tag{2}$$

where

CR=cost response measure, and
η_k=the standardized γ for each of the k coefficients.

The η parameter represents the impact of a change in the specific category of input costs (material, labor, or plant and equipment) upon the change in operating income. The aggregation of η_1 through η_3, therefore, measures the current response of operating income to cost changes across the range of input categories. Because of the difficulty in isolating the response of operating flows to a cost change in any one of the highly correlated specific input series, all available input categories were used to provide a more general indication of an individual firm's ability to respond to input cost changes, regardless of their specific source. In addition, the coefficients were standardized (divided by the standard deviation of the coefficient) to produce a common scale among the three production factors in the model.[7]

Table 1 provides summary data concerning industry (SIC) classifications and the rankings of the average cost response measure across industries. The rankings of the industries by the cost response measure indicate that some of the basic mineral extraction and processing industries have been able to maintain or increase operating income relative to their cost increases, during the time period studied. Other manufacturing concerns such as motor vehicles and instruments have not fared so well.

The cost response measured for each firm was used to rank the firms from highest to lowest. Two groups were then formed comprising the highest and lowest one-third of this measure for each of the three years under investigation.

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[7] A signed F-statistic was also used as an alternative cost response measure. This was defined as the F-statistic from model one in cases where the sum of the t-statistics was nonnegative, and the negative of the F-statistic in cases where this sum was negative. The overall cross-sectional regression results of the signed-F partition were very similar to those of the summed-t-statistic partition.

TABLE 1

INDUSTRY CLASSIFICATIONS AND COST RESPONSE MEASURES

Two-Digit SIC Code	*Industry*	*Number of Firms*	*Average Cost Response Measure*
33	Primary Metal	10	5.13291
29	Petroleum	7	2.48149
34	Fabricated Metal	3	2.06197
25	Furniture	1	1.67950
26	Paper	7	1.47189
24	Lumber	1	.82390
21	Tobacco	3	.77250
35	Machinery (excluding electric)	17	.10672
36	Electric Machinery	10	.02489
30	Rubber	3	−.12037
27	Printing and Publishing	1	−.21990
28	Chemicals	19	−.40171
20	Food	3	−.71583
38	Instruments	4	−.91525
37	Motor Vehicles	7	−1.02789
32	Stone, Clay, and Glass	7	−2.10480

This group formation procedure ensured a strictly positive *CR* measure for the "high" *CR* group and a strictly negative *CR* measure for the "low" *CR* group as well as limiting potential misclassifications likely to occur near the median. Subsequent to grouping the firms within each year, an analysis was performed on a three-year pooled basis.

Table 2 presents some descriptive statistics for equation (1) for the high and low *CR* groups as well as for the overall sample. The coefficients of determination indicate a greater average explanatory power for the high *CR* group. Note that there is a pattern of significant *F*-statistics among the higher quartiles and non-significance among the lower quartiles. The non-significant numbers are not surprising given the low power of the test resulting from the small sample size. Also provided are summary statistics of the individual cost response coefficients for the overall sample.

A list of firms for year 2 in each of the two *CR* subgroups is provided in Table 3. Year 2 was used in the Table 3 presentation because it provides the largest sample of which the other year's samples are subsets. The firms listed in Table 3 represent 38 different industries as categorized by SIC codes. For the most part firms within an industry are categorized in either the high or low *CR* groups. Crossovers appear in only four industry classifications, three of which (SIC codes 2111, 3560, and 3630) involve one firm in each group, and one (SIC code 2800) having two firms in the high *CR* group and five in the low.

Income Variables

Two alternative income variables were obtained for each firm for the years 1980 through 1983: historical cost income per share (before extraordinary items and discontinued operations) and total current cost income per share. Current cost from continuing operations and holding gain components for each firm, the supplementary current cost data mandated by SFAS No. 33, were gathered. Next,

TABLE 2

DESCRIPTIVE STATISTICS FOR COST RESPONSE REGRESSION

Eq. (1): $\Delta y_{it}=\alpha_i+\gamma_{i1}(\theta m_{dt})+\gamma_{i2}(\theta l_{dt})+\gamma_{i3}(\theta p_{dt})+\epsilon_{it}$

Panel A. Interquartile R² *and* F-*statistics for Various Cost Response Subgroups:*

Groups	*Interquartile Range*	R² *(percent)*	F-*statistic*
Overall Sample	.25	21.52	1.10
	.50	39.33	2.59
	.75	53.28	4.56**
High *CR* Group	.25	31.69	1.86
	.50	43.32	3.05*
	.75	61.85	6.49**
Low *CR* Group	.25	11.73	.53
	.50	26.42	1.44
	.75	44.73	3.24*

Panel B. Summary Statistics for Cost Response Regression Coefficients:

Variable	*Mean*	*Standard Error*	*Maximum*	*Minimum*
γ_{i1} (Labor)	.7354	.1967	5.8040	−4.4110
γ_{i2} (Material)	−.1931	.1086	3.1390	−2.9590
γ_{i3} (Overhead)	−.1330	.1313	2.8740	−3.3720

* Significant at the .10 level.
** Significant at the .05 level.

the total current cost income number was computed for each firm by adding the holding gain component, which on the FASB No. 33 tape is called "increase or decrease in current cost amounts" to the current cost income from continuing operations number.[8] All amounts were calculated on a per share basis and adjusted for changes in the number of shares over time.[9]

Because these numbers were used in explaining a security return metric, an unexpected measure of each was computed. The unexpected income measure represents the portion of the income variable assumed not to be anticipated by the market and, therefore, is a proxy for the information in the income number. Because of the annual release of the supplementary income measures and the short time series, a random walk process was used for total current cost and for historical cost income.

The following two models provided

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[8] Testing for the information effects of this variable in a multiple regression with historical cost income errors is essentially equivalent to testing the unrealized holding gain component or loss itself, a number not previously available to investors. See Revsine [1973, p. 73] and Christie et al. [1984, p. 210] for an analogous situation. Also, since Revsine's theory only predicts differential effects for the holding gain or loss component of total current cost income, the multiple regression tests presented below are not confounded by unequal unexpected current cost income components across subgroups and, therefore may, as argued by Revsine, more closely isolate the effects of the key total current cost income components.

[9] We also used inflation-adjusted current cost income numbers in the analysis as in Bublitz et al. [1985]. However, the empirical results indicate that the adjustment has a negligible effect in the association tests.

Table 3

Sample Firms for Year 2 (1982–1981) Included in High and Low Cost Response Groups

High Cost Response		*Low Cost Response*	
SIC	*Company Name*	*SIC*	*Company Name*
2111	Reynolds (R.J.) Industries	2020	Borden, Inc.
2520	Interlake, Inc.	2111	Philip Morris, Inc.
2600	Crown Zellerbach	2800	Du Pont (E.I.) De Nemours
2600	Union Camp Corporation	2800	FMC Corporation
2800	Grace (W.R.) & Company	2800	Hercules, Inc.
2800	National Distillers & Chemical	2800	PPG Industries, Inc.
2911	Mobil Corporation	2800	Pennwalt Corporation
2911	Phillips Petroleum Company	2830	American Home Products Corp.
2911	Shell Oil Company	2830	Schering-Plough
2911	Standard Oil Co. (Indiana)	2834	Pfizer, Inc.
2911	Sun Co., Inc.	2841	Colgate-Palmolive Company
2911	Texaco, Inc.	2844	Revlon, Inc.
2911	U.S. Steel Corporation	3079	Armstrong World Inds., Inc.
3000	Uniroyal, Inc.	3210	Libbey-Owens-Ford Company
3310	Armco, Inc.	3221	Corning Glass Works
3310	Bethlehem Steel Corporation	3241	Lone Star Industries
3310	Inland Steel Company	3270	National Gypsum Company
3310	LTV Corporation	3290	Owens-Corning Fiberglass Corp.
3310	Wheeling-Pittsburgh Steel	3530	Allis-Chalmers Corporation
3330	Aluminum Company of America	3533	Combustion Engineering, Inc.
3330	Reynolds Metals Company	3550	Emhart Corporation
3410	Crown Cork & Seal Co., Inc.	3560	Federal-Mogul Corporation
3410	National Can Corporation	3600	Westinghouse Electric Corp.
3440	Harsco Corporation	3630	Whirlpool Corporation
3540	Chicago Pneumatic Tool Co.	3651	RCA Corporation
3560	Ingersoll-Rand Company	3714	Borg-Warner Corporation
3630	Allegheny International, Inc.	3714	Fruehauf Corporation
3662	Raytheon Company	3720	Sundstrand Corporation
3674	Texas Instruments, Inc.	3720	United Technologies Corp.
3680	Burroughs Corporation	3721	Textron, Inc.
3680	NCR Corporation	3820	Eaton Corporation
3760	Lockheed Corporation	3861	Polaroid Corporation

the income variables used in all tests for informational effects:

$$TCE=\frac{TCI_t-TCI_{t-1}}{MV_{t-1}} \tag{3}$$

$$HCE=\frac{HCI_t-HCI_{t-1}}{MV_{t-1}} \tag{4}$$

where

TCI_t = total current cost income per share at time t,
HCI_t = historical cost income (before extraordinary items and discontinued operations) per share at time t, and
MV_t = market value of equity per share at time $t-1$.

Rank correlations among the alternative income variables and cumulative abnormal returns (henceforth referred to as *CAR*, and defined below) are provided in Table 4. The correlations are computed for each of the three years as well as for the subgroups of firms divided on

TABLE 4

RANK CORRELATIONS BETWEEN INCOME VARIABLES AND CUMULATIVE ABNORMAL RETURNS (*CAR*): ALL FIRMS, HIGH, AND LOW COST RESPONSE FIRMS

	Pooled	*1981*	*1982*	*1983*
All Firms:				
HCE vs. *TCE*	.604***	.449***	.780***	.551***
HCE vs. *CAR*	.171***	.259***	.134	.111
TCE vs. *CAR*	.067	.029	.111	.048
High Cost Response:				
HCE vs. *TCE*	.649***	.764***	.800***	.401**
HCE vs. *CAR*	.199**	.386**	.149	.198
TCE vs. *CAR*	.308***	.261*	.292*	.366**
Low Cost Response:				
HCE vs. *TCE*	.440***	.177	.571***	.587***
HCE vs. *CAR*	.254***	.370*	.038	.217*
TCE vs. *CAR*	−.035	.070	−.168	−.345

* Significant at the .10 level.
** Significant at the .05 level.
*** Significant at the .01 level.
HCE=historical cost forecast error
TCE=total current cost income forecast error
CAR=cumulative abnormal return

the basis of their input cost response measures. Note that while these correlations indicate a substantial commonality between the two variables they do not indicate a severe problem with instability in the multiple-regression estimation process which occurs when the squares of these values approach one [Kmenta, 1971].[10]

Table 4 provides preliminary evidence of a differential association between *TCE* and *HCE* for the high versus low cost response groups. In all cases the (*TCE*, *CAR*) correlation is nominally larger in the high cost response group than in the low cost response group, and in three of the four subgroups the association is opposite in sign. Also, note that a similar pattern does not appear for the *HCE*-versus-*CAR* subgroups. These data are consistent with a grouping effect.

Security Return Metric

Abnormal security returns were used as the sole dependent variable in the analysis. A 48-month period, prior to the test period, was used to estimate the parameters of the standard market model with a value-weighted index. Abnormal returns in the test years were then aggregated for $t=1,12$ to provide for three, 12-month-period cumulative abnormal returns (*CAR*s) for all firms in the analysis, beginning in April of 1980,

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[10] Kmenta [1971, p. 391] also points out that the inferential effect of multicollinearity is to produce a wide acceptance region for the null hypothesis that a given coefficient is zero. Therefore, a test is less powerful at high levels of multicollinearity. Christie et al. [1984] provide an analysis of the situations when multicollinearity becomes a serious problem in the estimation process. Unfortunately, no generally acceptable remedy within the class of linear, unbiased estimators is available.

1981, and 1982.[11] This holding period was chosen to capture the information which might not have been available before the release of the annual report—assumed to be available prior to the last day in March, the twelfth month. Because quarterly current cost data are not disclosed, the latest reported current cost income information available to provide an expectation for the next set of current cost numbers was from the previous year's annual data.

CROSS-SECTIONAL INFORMATION EFFECTS REGRESSIONS

The cross-sectional regressions use ranked security return metric as the dependent variable and each of the two income measures' ranks as independent variables. The ranking transformation provides a basis for pooling the three years of data and comparing regression results across time.[12] The cross-sectional approach is similar to that used in previous cross-sectional studies such as Beaver et al. [1979], Beaver et al. [1982], and Bublitz et al. [1985].

Multiple regressions were used to assess the incremental information content in total current cost income beyond that provided by historical cost income as follows:

$$e_{it}=\alpha_t+\delta_t(HCE_{it})+\Psi_t(TCE_{it}) + w_{it} \qquad (5)$$

where

$e_{it}=CAR$, defined above as the aggregated (across 12 months) to test period t for firm i,
α_t = intercept for year t, and
w_{it} = error term, $E(w_{it})=0$.

In each of the three years under study, three regression equations were estimated. First, regressions were run for all firms in the analysis. Next, these firms were subdivided on the basis of their cost response (CR) measures into high (H) and low (L) groups. The high and low groups consisted of the top and bottom one-third of the sample firms respectively, ranked by the CR measure. Finally, the three regressions were estimated using pooled data across all firms over time. As an overall test for a differential cost response effect the coefficients of H and L groups were tested for equality.

The grouping procedures were used to provide *a priori* expectations of differential associations with the security return metric. Therefore, the following general hypothesis was tested in relation to the associative effects of total current cost income:

H_0^1: $\alpha_H=\alpha_L$ and $\delta_H=\delta_L$ and $\Psi_H=\Psi_L$

H_A^1: $\alpha_H\neq\alpha_L$ or $\delta_H\neq\delta_L$ or $\Psi_H\neq\Psi_L$,

where $\{\alpha_H, \delta_H, \Psi_H\}$ and $\{\alpha_H, \delta_L, \Psi_L\}$ are the equation (5) high and low CR subgroup coefficients respectively. H_0^1 represents a simultaneous hypothesis for equality of coefficients in the two subgroups. It tests for an overall difference between the two equations and is followed by:

H_0^2: $\Psi_H=\Psi_L$

which tests for a specific CR effect on the *TCE* coefficient. Rejection of H_0^1 and H_0^2 would be supportive of the economic

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[11] The *CAR*s were aggregated according to $[\Pi_t(1+\xi_t^*)-1]$, where ξ_t^* is the residual from applying the marked model to the test years.

[12] All variables in the regression equation were ranked across firms within years. Analysis of the sample skewness and kurtosis (e.g., 5.64 and 76.03, respectively in the pooled sample for *TCE*) indicated considerable nonnormality. Ranks have the advantage of being insensitive to outliers and departures from normality. Also, the use of ranks as instruments for the original variables yield asymptotically unbiased estimates with no increase in alpha error [Goldberger, 1964, pp. 284–286]. The tests were replicated using unranked data for the pooled sample with no practical differences resulting.

TABLE 5

TESTS OF EQUALITY OF CROSS-SECTIONAL REGRESSION EQUATIONS AND COEFFICIENTS ACROSS HIGH (H) AND LOW (L) COST RESPONSE GROUPS

Eq. (5): $e_{it}=\alpha_t+\delta_t(HCE_{it})+\Psi_t(TCE_{it})+w_{it}$

	F-*tests*			
Hypotheses	*1981*	*1982*	*1983*	*Pooled*
H^1_A: $\{\alpha_H, \delta_H, \Psi_H\} \neq \{\alpha_L, \delta_L, \Psi_L\}$	1.71	6.86**	10.83**	3.45*
	t-*tests*			
	1981	*1982*	*1983*	*Pooled*
H^2_A: $\{\Psi_H\} \neq \{\Psi_L\}$	−.33	2.94**	5.85**	3.97**

* Significant at the .05 level.
** Significant at the .01 level.

rationale cited above that cost increases have different interpretations for high and low response groups.

Next, specific incremental information hypotheses are tested within the separate high and low response groups. The incremental information in total current cost income within the high cost response group was tested by the following directional hypothesis:

H^3_0: $\Psi_H \leq 0$.

The above hypothesis relates to the tests of those firms who are grouped among those better able to maintain operating income as input costs increase. For those firms relatively less able to maintain operating income, a one-sided alternative in the opposite direction as H^3_0 is suggested:[13]

H^4_0: $\Psi_L \geq 0$.

All hypotheses were tested using the data pooled across years as well as for individual years.

Results

Table 5 presents t-tests and F-tests [Kmenta, 1971, p. 373] for the two hypotheses (H^1_0 and H^2_0) that test for equality between the high and low CR group regression coefficients. Note that in the pooled sample, as well as in two of the three years tested, both test statistics are significantly different from zero. These results are consistent with a differential cost response effect and supportive of the arguments by Revsine.

Table 6 contains the multiple regression coefficients and t-statistics for earn-

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[13] There are some reasons to believe that the alternative hypothesis be two-sided. If a firm purchased assets before a price rise, the firm may have received a one-time benefit which may be indicative of superior management holding activities as suggested by Edwards and Bell [1961, p. 93]. On the other hand, the firm may be faced with higher costs which it is unable to pass on in the form of higher output prices. Thus, depending on the relative magnitude of these potential effects, the coefficient could be either positive or negative in value. However, given the partitioning in this study, the low cost response firms are likely to be able to pass on input price increases to sales and, therefore, these firms should experience some negative cash-flow effects. This scenario is consistent with Revsine's hypothesis about his type B and C firms which predicts either a negative or counterbalanced cash-flow effect. Therefore, within the Revsine framework, positive net cash flow effects are not expected for these firms and, therefore, a one-sided alternative hypothesis was used.

TABLE 6

TESTS FOR THE INCREMENTAL INFORMATION IN *TCE* AND *HCE*
(Source Statistics for Tests of H_0^3–H_0^4)

	Coefficient (t-*statistic*)		*Regression Eq.* (*6*)		
Sample	TCE	HCE	F-*statistic*	R²	n
Pooled					
All Firms	−.06 (−.76)	.21 (2.76)***	4.46**	.031	280
High Cost Response Firms	.29 (2.35)***	−.01 (−.02)	4.72**	.095	93
Low Cost Response Firms	−.20 (−1.63)*	.38 (2.99)***	4.52**	.091	93
1981					
All Firms	−.11 (−.97)	.31*** (2.72)	3.74**	.077	93
High Cost Response Firms	−.07 (−.30)	.37 (1.66)**	3.50**	.152	31
Low Cost Response Firms	−.01 (−.01)	.42 (2.07)***	2.22	.137	31
1982					
All Firms	.02 (.09)	.12 (.78)	.87	.018	97
High Cost Response Firms	.46 (1.64)*	−.21 (−.80)	1.71	.105	32
Low Cost Response Firms	−.25 (−1.28)	.18 (.91)	.85	.055	32
1983					
All Firms	−.02 (−.15)	.12 (.95)	.56	.013	90
High Cost Response Firms	.28 (1.75)**	.05 (.31)	2.14	.137	30
Low Cost Response Firms	−.81 (−3.87)***	.72 (3.44)***	8.52***	.387	30

* Significant at the .10 level.
** Significant at the .05 level.
*** Significant at the .01 level.

ings variables for firms classified as "high cost response" and "low cost response" as well as on a pooled basis. Note the difference in the magnitude of the *TCE* coefficient (and *t*-statistics) for the high versus low cost response groups across the pooled and individual year samples. In the pooled sample, the *TCE* coefficients are both statistically significant and opposite in sign. Similar results appear for 1982 and 1983. Finally, in the "all firms category," the *TCE* coefficient test is not significant for any of the four samples. Therefore, these tests are supportive of an incremental effect for *TCE*; however, this would be obscured if the firms are not grouped according to their ability to pass on cost increases.

These results are consistent with Revsine's theoretical analysis of the holding gain or loss component of total current cost income when this analysis is extended to the incremental information in *TCE*. Given an increase in asset prices, in general, firms in the "high" cost response group have been relatively successful in adjusting their operating flows accordingly.

Also consistent with theoretical predictions based on Revsine's analysis are the results from the relatively "low cost response" firms. For these firms a negative relationship has existed between input price changes and operating flows. Although input costs have risen, the firms in this group have not been able to adjust their operating flows accordingly.

The multiple regression results must be viewed in light of the relatively high degree of collinearity between the two independent variables. The positive correlations may indicate that the variances of the sampling distributions of the coefficient estimators may be large and, thus, limit the power of the statistical tests. As a result, inferences regarding the separate influences of each of the explanatory variables must be viewed as conservative, and should be cautiously interpreted for the nonsignificant *t*-statistics.

An additional consideration is the possibility of some impact of residual cross-sectional correlation (*RCC*) on the indicated alpha levels reported in Table 6. However, this problem is mitigated in the context of the present study. First, the research on *RCC* has been primarily concerned with underestimating the *standard errors* of the regression coefficients as opposed to biases in estimating the regression coefficients themselves (e.g., Bernard [1987]). This is important because most of the high cost group regression coefficients in Table 6 differ in sign from the low cost response groups. Second, the largest source of *RCC* observed by Bernard was due to intra-industry effects at the 3-digit SIC code level. However, the present sample is well-diversified at this level (33 different industries at the 3-digit level), with each industry containing a relatively small number of firms.[14]

Finally, Table 7 is provided for descriptive purposes, and gives the results of estimating equation (5) for a larger SFAS No. 33 data-tape sample than used in the present study. The sample constraints are the same as applied in the present study, but there is no requirement of input price availability. Also, for comparability purposes, the unexpected income numbers are scaled by price and ranked, as they are in the present study. These procedures differ from those used in previous studies; however, they allow a direct comparison between Tables 6 and 7.

The coefficients for the pooled sample in Table 7 are similar in sign and magnitude to those for the pooled sample in Table 6. Specifically, the pooled sample coefficients in Table 7 are −.10 (for *TCE*) and .34 (for *HCE*) versus the pooled sample coefficients in Table 6 of −.06 (for *TCE*) and .21 (for *HCE*). Note, also, that in comparing Tables 6

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[14] To assess the potential effects of *RCC* on the results, we treated firms within each industry as a single sample point for the high CR group for the pooled sample. Results for this reduced sample (49 observations) confirmed the full sample results with the *t*-statistic for the *TCE* coefficient, being 1.79 which is significant at the .05 level.

TABLE 7

TESTS FOR THE INCREMENTAL INFORMATION IN *TCE* AND *HCE*: LARGER SFAS NO. 33 SAMPLE

Eq. (5): $e_{it}=\alpha_t+\delta_t(HCE_{it})+\Psi_t(TCE_{it})+w_{it}$

	Coefficient (t-*statistic*)				
Samples	TCE	HCE	F-*statistic*	R^2	n
Pooled	−.10 (−3.17)***	.34 (11.02)***	62.04**	.09	1199
1981	−.12 (−2.59)***	.45 (9.36)***	43.80**	.18	402
1982	−.10 (−1.89)*	.37 (7.09)***	26.10**	.12	402
1983	−.02 (−.39)	.15 (2.55)***	3.83**	.02	395

* Significant at the .10 level.
** Significant at the .05 level.
*** Significant at the .01 level.

and 7, both the signs and magnitudes of *TCE* and *HCE* agree in all cases but for 1982. However, since the results reported in Table 6 are weakest in 1982, the unusual nature of the 1982 sample cannot explain the results reported in Tables 5 and 6.

CONCLUSIONS

This study examined the association of risk-adjusted security returns with current cost income under alternative cost response conditions. The association between operating income and specific (industry level) input cost changes provided for a differential grouping of firms. Multiple regression models using total current cost income as one of the independent variables provide some empirical support of an association between *TCE* and risk-adjusted returns. In other words, if a firm is able to maintain operating income during periods of cost increases, holding gains may be viewed as providing additional "good news" about the firm, or at the very least, not merely a signal of increased future costs with no corresponding increase in operating flows. On the other hand, for the group of firms who were relatively unable to maintain operating income in the face of cost increases, the holding gain inclusion appeared to diminish (or make negative) the incremental association between the total current cost income number and risk-adjusted security returns. An important finding is that the high and low cost response groups have coefficients with different signs. These results are consistent with the arguments of Revsine [1973] and they contradict the predictions of a uniformly positive sign on *TCE* commonly found in previous research on SFAS No. 33 income variables.

In interpreting these results it should be noted that two sampling constraints used in the present research place certain restrictions on generalizability. First, the SFAS No. 33 data-tape excludes certain industries (e.g., financial) and small firms. Second, the availability of input-price indices excludes additional industries. Thus, generalizations to firms that differ economically from those used in the present study may be inappropriate.

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The Incremental Information in SFAS No. 33 Income Disclosures Over Historical Cost Income and Its Cash and Accrual Components

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ABSTRACT: This study investigates the incremental information in alternative measures of constant dollar and current cost operating income reported under SFAS No. 33 over historical cost income and its cash and accrual components. To do so, it examines contemporaneous associations between unexpected returns at the time of release of the annual report or 10-K report and variables measuring the unexpected components of these alternative income measures. The research design exploits the difference in timing of the release of historical cost income and of SFAS No. 33 income. The empirical analysis indicates that current cost and constant dollar operating income measures have incremental information over historical cost income and its cash and accrual components. The results also indicate that there is incremental information in cash flow over that conveyed by alternative measures of constant dollar and current cost operating income. However, incremental information in SFAS No. 33 measures and of cash flow is observed only for a subset of the industries examined.

SINCE the 1979 issuance of SFAS No. 33, considerable empirical research has examined the incremental information in alternative income measures adjusted for specific and general price changes over that of historical cost income. The methods used in these studies have been varied and the empirical findings have been mixed. For example, Beaver and Landsman [1983] and Beaver and Ryan [1985] found that SFAS No. 33 income measures had no information beyond that of historical cost income. Using various research design modifications, Bublitz et al. [1985] found that several SFAS No. 33 income measures contributed significantly to explaining that portion of the cross-sectional variation in unexpected security returns not explained by historical cost income. A common feature of these and other studies on this topic is the investigation of a

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lead association between alternative income measures and stock returns. The relation between stock returns (or some transformation of stock returns) measured over the 12-month period coinciding with the fiscal year (or ending with the month during which the annual report was published) and alternative income variables is examined using multiple regression.

The purpose of this study is to examine the incremental information in alternative measures of current cost and constant dollar income reported under SFAS No. 33 over that of historical cost income. Whereas previous research on this topic has examined lead associations between returns and alternative income measures, the focus in this study is on contemporaneous associations. Our tests rely on the difference between the timing of the historical cost income announcement in *The Wall Street Journal* and the disclosure of alternative current cost and constant dollar income measures in the annual report.[1] We assess the incremental information in these current cost and constant dollar income measures by examining their contemporaneous associations with stock price changes during the week of release of the annual report.

The empirical findings show significant contemporaneous associations between unexpected returns in the week of release of the annual report and the unexpected portions of current cost and constant dollar income measures. These results support the findings of Bublitz et al. [1985] that certain income measures reported under SFAS No. 33 convey incremental information over historical cost income. Our results also support the hypothesis of incremental information in cash flow over each of the SFAS No. 33 income measures. However, these findings are observed only for some of the industries examined.

The rest of this paper is organized as follows. Section I discusses problems with using lead associations for examining the incremental information in SFAS No. 33 income measures and presents the advantages of examining contemporaneous associations. Section II describes the sample selection procedures and the research design. Section III presents the empirical results and Section IV contains a summary and conclusions.

I. Motivation for Examining Contemporaneous Associations

Prior research on the incremental information in SFAS No. 33 income disclosures has examined the relation between stock returns computed over a 12-month period and variables measuring the unexpected portions of historical cost income and SFAS No. 33 income. For example, Beaver and Landsman [1983] and Beaver and Ryan [1985] use total stock returns measured over the calendar year. Bublitz et al. [1985] use abnormal returns accumulated over the April to March period. Cross-sectional dependence is likely to exist in studies such as these, since stock returns are measured over common time periods. The presence of cross-sectional dependencies can lead to biased estimates of standard errors and, therefore, to incorrect inferences in hypothesis tests. Bernard [1987] demonstrates that this bias is especially severe when ordinary least squares estimation is used in cross-sectional regressions of annual returns on firm-specific measures of unexpected earnings. Yet, generalized least squares estimation is not feasible in the SFAS No. 33 context because of the lack of a sufficiently long time series of observations.

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[1] Wilson [1987] exploits this difference in timing to examine whether the accrual and funds components of earnings convey information beyond that provided by historical cost earnings. The research design of this study is similar to that of Wilson [1987]. Stober [1986] uses a similar approach to examine the incremental information in LIFO inventory liquidations.

This study examines contemporaneous associations between SFAS No. 33 income variables and unexpected stock returns in the week of release of the annual reports. As with prior research, incorrect inferences may be drawn because of the presence of cross-sectional dependence. However, two features of the research design of the present study will attenuate this problem. First, unexpected returns are not measured during the same week for all firms because all firms' annual reports are not released during the same week.[2] Thus, the level of cross-correlation between abnormal returns is reduced and so is the bias in estimating the standard errors of the coefficients in a cross-sectional regression. Second, abnormal returns are measured over a one-week period. Bernard [1987] demonstrates that problems resulting from cross-sectional correlation are less severe when returns are measured over short time intervals.

Another problem encountered in prior SFAS No. 33 studies is the high levels of correlation between the historical cost income variable and each of the SFAS No. 33 income variables. Because of the high levels of collinearity, incremental information is small and, therefore, difficult to detect, using cross-sectional multiple regression as in Bublitz et al. [1985] or two-stage simple regression as in Beaver and Landsman [1983] and Beaver and Ryan [1985].

The research design in this study exploits the difference in timing between the historical cost income announcement in *The Wall Street Journal* and the disclosure of SFAS No. 33 income in the annual report or 10-K filings. We assume that the date historical cost earnings are published in *The Wall Street Journal* is a close proxy for the date on which firms release them.[3] In contrast to historical cost earnings, SFAS No. 33 earnings are released in annual reports and 10-K filings. We assume that the earlier of the annual report arrival date and the 10-K arrival date at the SEC is a close proxy for the date on which SFAS No. 33 earnings information is first available to investors.[4]

Under semi-strong market efficiency, one would expect the market to react to the historical cost earnings information at the time of its release in *The Wall Street Journal*. For 97 percent of the observations in this study the historical cost earnings announcements in *The Wall Street Journal* preceded either the annual report arrival date or the 10-K arrival date at the SEC by two weeks or longer. Thus, any market reaction to the historical cost earnings announcement will have taken place before the SFAS No. 33 earnings information becomes available. To the extent that there is incremental information conveyed by SFAS No. 33 earnings over historical cost earnings, there will be a stock market reaction at the time of release of the annual report or 10-K, a reaction that is associated with the release of the SFAS No. 33 earnings and not historical cost earnings.

A problem with this approach is that the annual report or 10-K report contains considerable information besides historical cost and SFAS No. 33 earnings. Wilson [1987] has demonstrated that cash and accrual information disclosed in the annual report or 10-K report conveys incremental information beyond historical cost earnings. In order that incremental information not be ascribed to SFAS No. 33 earnings when, in fact, it is due to the cash and accrual information conveyed in the annual report or 10-K report, the research is designed to control for the effects of cash and accrual information. Thus, this study may be viewed as a test of the incremental information content of SFAS No. 33 earnings over the cash and accrual components of historical cost earnings.

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[2] Note that, because the sample comprises only December 31 year-end firms, there will be some overlap in the sample firms' annual report release weeks.

[3] Abdel-khalik [1984] provides evidence that the earnings publication date in *The Wall Street Journal* is usually within two days of the date of the earnings release.

[4] Stober [1986] uses a similar proxy for the financial statement release date.

II. RESEARCH DESIGN

Data Requirements and Sample Selection

The following data requirements had to be satisfied for inclusion in the sample:

1. Constant dollar and current cost operating income, purchasing power gain or loss, and holding gain data were available in the SFAS No. 33 Data Bank tape.
2. Historical cost operating income, working capital from operations, current assets, and current liabilities were available in the COMPUSTAT file.
3. Daily common stock returns were available in the CRSP file.
4. Arrival dates of the annual reports and/or 10-K reports at the SEC were available in the SEC's automated data base.

In addition to the data requirements listed above, sample firms were required to have December 31 fiscal year-ends and belong to industry groups (based on two-digit SIC codes) with six or more observations each year. Firms belonging to industry groups with SIC codes greater than 4000 (mainly utilities and financial companies) and other industries with small numbers of companies with December 31 fiscal year-ends were eliminated. Financial companies show little difference between historical cost income and current cost or constant dollar income because SFAS No. 33 does not require revaluation of monetary assets and liabilities, and the fixed assets of financial companies are a small portion of their total assets. SFAS No. 33 data is not expected to provide significant additional relevant information for determining stock prices of utilities because future cash flows of utilities are largely determined by rate regulation which is predominantly based on historical cost information.[5,6] At least six observations per year from each industry group were required to ensure that a sufficient number of observations were available for estimating industry effects on the relation between unexpected returns and unexpected SFAS No. 33 income measures.[7]

The effects on sample size of the data requirements and sample selection criteria are summarized in Table 1. The

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[5] The most common approach to rate making is to charge customers for service so that the total amount paid by all customers is equal to the cost of the service. The cost of service is determined as the sum of (a) operation and maintenance expenses, depreciation and amortization expenses, and income and other taxes, and (b) in the case of public utilities, an allowance for capital. Most state regulatory commissions require the use of *HC* for determining (a) and (b) above.

Olsen [1985] examines valuation implication of SFAS No. 33 data for "electric utility" investors. He finds that the SFAS No. 33 disclosures do not provide consistently significant incremental information over *HC* disclosures.

[6] This statement assumes that regulators will not use SFAS No. 33-type income measures in future rate-setting.

[7] Using time-series analysis, Bernard and Ruland [1987] report that the incremental information in current cost income differs across industries.

TABLE 1

SAMPLE SELECTION CRITERIA AND THEIR EFFECTS ON SAMPLE SIZE

Sample Selection Criteria	Time Period 1980	1981	1982	Total
Total number of firms in the nonfinancial files of the SFAS No. 33 Data Bank tape from industries with SIC codes less than 4000	625	625	410	1,660
Less: Firms with missing data on:				
SFAS No. 33 Data Bank tape	311	225	219	775
COMPUSTAT file	78	74	43	195
CRSP daily returns file	12	15	17	44
	224	301	131	656
Less: Firms with non-December 31 fiscal year-ends	72	85	4	161
	152	216	127	495
Less: Firms from industries with less than six observations in any year	25	41	20	86
TOTAL SAMPLE	127	175	107	409

final sample consisted of 409 observations over the three-year period 1980–1982. There were 127 observations in 1980, 175 in 1981, and 107 in 1982. Classification of the sample firms by industry is summarized in Table 2.

Identification of SFAS No. 33 Earnings Release Dates

The proxy for the date on which SFAS No. 33 earnings data are first available to investors is defined as the earlier of:

(1) the date the annual report arrived at the SEC, and
(2) the date the 10-K report arrived at the SEC.

These data were collected from the SEC's automated data base in Washington, D.C.

Figure 1 presents summary information about the number of weeks by which the historical cost earnings announcement in *The Wall Street Journal* preceded the SFAS No. 33 earnings release date. The average difference was six weeks.[8] In 97 percent of the cases (396 out of 409 cases), the historical cost earnings announcement preceded the SFAS No. 33 earnings release by two weeks or longer.[9] In only one case did the SFAS No. 33 earnings release precede the historical cost earnings announcement.

Measuring Earnings and Cash Flow

The earnings variables used include historical cost (HC), current cost (CC)

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[8] Stober [1986] reports an average difference of 5½ weeks for his sample.

[9] The empirical analysis was repeated using these 396 observations. The results differ very little from those obtained using all 409 observations.

TABLE 2

CLASSIFICATION OF SAMPLE BY INDUSTRY

SIC Code	Description	Time Period 1980	1981	1982	Total
13	Oil and Gas Extraction	6	12	7	25
26	Paper and Allied Products	7	13	12	32
27	Printing, Publishing, and Allied Industries	7	8	7	22
28	Chemicals and Allied Products	31	39	13	83
29	Petroleum Refining and Related Industries	8	15	14	37
32	Stone, Clay, Glass, and Concrete Products	9	12	10	31
33	Primary Metal Industries	13	19	14	46
35	Machinery, Except Electrical	17	22	10	49
36	Electrical and Electronic Machinery, Equipment and Supplies	19	24	11	54
37	Transportation Equipment	10	9	9	28
TOTAL SAMPLE		127	175	107	409

and constant dollar (CD) operating incomes, constant dollar operating income plus purchasing power gain or loss (CDP), current cost operating income plus purchasing power gain or loss (CCP), current cost operating income plus holding gain (CCH), and current cost operating income plus purchasing power gain or loss plus holding gain (CCPH). These earnings measures were used by Beaver and Landsman [1983] and Bublitz et al. [1985]. Cash flow from operations (CF) is defined as working capital from operations plus current accruals (i.e., the net changes in all working capital accounts except for changes in cash, short-term investments, and short-term debt).

All earnings and cash flow variables are expressed as changes in their corresponding per share values from the preceding year and are deflated by each firm's market price per share of common stock at the beginning of the period. Changes in each variable are computed as follows:

$$\Delta X_{it}=[(X_{it}/NSH_{it})-(X_{i,t-1}/NSH_{i,t-1})]/MV_{i,t-1}$$

where

X_{it} = historical cost operating income (HC) or cash flow from operations (CF) or any one of the price-change-adjusted earnings measures reported under SFAS No. 33 (PCE) for firm i in year t,

NSH_{it} = number of common shares used in computing primary earnings per share for firm i in year t, and

$MV_{i,t-1}$ = per share market value of common equity of firm i at the beginning of year t, which is measured as:

$$\frac{(\text{Price per share})_{i,t-1}\times(\text{Number of shares outstanding})_{i,t-1}}{NSH_{i,t-1}}.$$

FIGURE 1

FREQUENCY DISTRIBUTION OF THE NUMBER OF WEEKS BY WHICH THE HISTORICAL COST EARNINGS ANNOUNCEMENT IN *The Wall Street Journal* PRECEDED THE SFAS NO. 33 EARNINGS RELEASE

Interval (Weeks)	*Number of Observations*	
−2	1	*
−1	0	
0	9	**
1	3	*
2	15	***
3	20	****
4	34	*******
5	62	*************
6	77	****************
7	76	****************
8	68	**************
9	34	*******
10	9	**
11	1	*
Total	409	

Mean: 42.23 Days Standard Deviation: 15.04 Days

All variables are adjusted for changes in the number of shares outstanding during the year in question.

Models of Unexpected SFAS No. 33 Earnings and Cash Flows

Unexpected SFAS No. 33 earnings are defined as:

$$U\Delta PCE_{it}=\Delta PCE_{it}-E(\Delta PCE_{it})$$
$$=\Delta PCE_{it}-\Delta HC_{it}.$$

Similarly, unexpected cash flow from operations is defined as:

$$U\Delta CF_{it}=\Delta CF_{it}-E(\Delta CF_{it})$$
$$=\Delta CF_{it}-\Delta HC_{it}.$$

These models define expected changes in SFAS No. 33 earnings and cash flow as the change in historical cost earnings. Historical cost earnings information is available to investors prior to the release of SFAS No. 33 earnings or cash flow and, to the extent that it conveys information about those variables, will be used by investors in forming expectations about those variables. Therefore, it is explicitly incorporated in the models used for estimating unexpected SFAS No. 33 earnings and unexpected cash flow.[10]

The models for computing unexpected amounts of SFAS No. 33 earnings and cash flow have several advantages. First, they permit the amounts of unexpected SFAS No. 33 earnings and cash flow to vary across firms depending on the relation between the change from the preceding year in each of those variables and the change in historical cost earnings. Firms whose SFAS No. 33 earnings are more affected by price changes in a given year will have larger unexpected amounts for those earnings measures. Second, these models permit the amounts of unexpected SFAS No. 33 earnings and cash flow to vary over time. A given firm will be affected differently over time by differing amounts of price changes.

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[10] Note that measuring unexpected cash flow from operations as defined here is equivalent to measuring the change in accruals to (ΔACC). In other words, given knowledge of ΔHC_t, knowledge of ΔCF_t implies knowledge of ΔACC_t and vice versa.

A disadvantage of the models for computing unexpected earnings and cash flows is that they ignore information about one firm that may be useful for forming expectations about another firm. Thus, models of unexpected earnings and cash flow will be deficient to the extent that such cross-sectional information is useful for forming expectations. However, an implicit assumption underlying such cross-sectional expectations models is the availability of information about the independent variables used in those models for *every* firm in the cross-section prior to the availability of information about the dependent variable for *any* firm in the cross-section. Pooling data over time would certainly violate this assumption. Even if cross-sectional models are estimated each year, some firms' annual reports and/or 10-K reports will have been released before other firms' historical cost earnings are announced, thereby violating this information availability assumption.[11]

Model for Assessing Incremental Information

Our objective is to assess the incremental information in alternative measures of price-adjusted earnings reported under SFAS No. 33 over the cash and accrual components of historical cost earnings. To do so, we estimate the following equation:

$$UR_{it}=\sum_{j=1}^{10}\beta_j D_j+\sum_{j=1}^{10}\gamma_j D_j U\Delta PCE_{it}+\sum_{j=1}^{10}\delta_j D_j U\Delta CF_{it}+\epsilon_{it} \qquad (1)$$

where

UR_{it} = unexpected return for firm i in period t, which is the prediction error in week 0 from a market model estimated using 100 weekly returns prior to week 0,

D_j = 1 if firm i belongs to industry $j=k$ for $k=1,\ldots,9$,

D_{10} = 1, and

ϵ_{it} = disturbance term.

Equation (1) allows the intercept and the slope coefficients to differ across industries, thereby placing no restrictions on those coefficients for each industry. There are several reasons for allowing such flexibility. First, the implications for security returns of price changes could vary across industries depending on their economic characteristics. Factors related to the output or input markets in which firms operate such as the ability to pass on the impact of price changes to customers and/or to decrease the impact of price changes through cost control measures could result in variations in the relation between security returns and SFAS No. 33 earnings. For example, Davidson and Weil [1975] and Falkenstein and Weil [1977] report that the differences between SFAS No. 33 price-change-adjusted earnings and historical cost earnings depend upon inventory flow assumptions, inventory turnover, depreciation methods, and fixed asset turnover; factors that vary by industry.

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[11] This is a potential problem with the approach used by Wilson [1987].

TABLE 3

SUMMARY STATISTICS FOR TESTING WHETHER THE RELATION BETWEEN UNEXPECTED RETURNS, AND UNEXPECTED SFAS NO. 33 EARNINGS AND UNEXPECTED CASH FLOW DIFFERS ACROSS INDUSTRIES

($n=409$)

Equation (1): $UR_{it}=\sum_{j=1}^{10}\beta_j D_j+\sum_{j=1}^{10}\gamma_j D_j U\Delta PCE_{it}+\sum_{j=1}^{10}\delta_j D_j U\Delta CF_{it}+\epsilon_{it}$

	Null Hypotheses		
Coefficients: SFAS No. 33 Earnings Measure	$\beta_1=\beta_2=\ldots=\beta_9=0$ F-*statistic*	$\gamma_1=\gamma_2=\ldots=\gamma_9=0$ F-*statistic*	$\delta_1=\delta_2=\ldots=\delta_9=0$ F-*statistic*
CC	1.693*	1.930**	3.811***
CCP	1.471	1.721*	3.882***
CCH	1.209	0.973	3.517***
CCPH	1.460	0.689	3.555***
CD	1.018	4.412***	4.103***
CDP	1.123	2.604***	3.960***

* Significant at the .10 level.
** Significant at the .05 level.
*** Significant at the .01 level.

Notes: UR = unexpected security return in the annual report week.
$U\Delta PCE$ = unexpected change in any one of the SFAS No. 33 earnings measures.
$U\Delta PCF$ = unexpected change in cash flow from operations.
D = industry indicator variable.
HC = historical operating income.
CC = current cost operating income.
CCP = current cost operating income plus purchasing power gain or loss.
CCH = current cost operating income plus holding gain.
CCPH = current cost operating income plus purchasing power gain or loss plus holding gain.
CD = constant dollar operating income.
CDP = constant dollar operating income plus purchasing power gain or loss.

The formulation of equation (1) facilitates testing for differences between the coefficients of unexpected price-change-adjusted earnings or unexpected cash flow across industries. Failure to reject the hypothesis that $\gamma_1=\gamma_2=\ldots=\gamma_9=0$ ($\delta_1=\delta_2=\ldots=\delta_9=0$) would imply that the relation between unexpected returns and unexpected price-change-adjusted earnings (unexpected cash flow) does not differ significantly across industries and that a model that restricts these coefficients to be equal across industries would be appropriate. Similarly, failure to reject the hypothesis that $\beta_1=\beta_2=\ldots=\beta_9=0$ would suggest that a common intercept for all industries would be appropriate.

III. RESULTS

Primary Results

Equation (1) was estimated using ordinary least squares estimation. Data for estimating equation (1) were pooled over the three-year period, 1980 to 1982. Because of the large numbers of parameters estimated, only summary statistics are presented. Table 3 reports the values of the *F*-statistics for testing the hypotheses that $\beta_1=\beta_2=\ldots=\beta_9=0$, $\gamma_1=\gamma_2=\ldots$

$=\gamma_9=0$, and $\delta_1=\delta_2=\ldots=\delta_9=0$ for each of the six SFAS No. 33 price-adjusted earnings variables defined earlier.

The F-statistics reported in Table 2 indicate that the null hypothesis that $\gamma_1=\gamma_2=\ldots=\gamma_9=0$ can be rejected at the 0.10 level in four of the six regressions and the null hypothesis that $\delta_1=\delta_2=\ldots=\delta_9=0$ can be rejected at the 0.01 level in all six regressions. This indicates that there are significant differences across industries in the coefficients of the unexpected cash flow and SFAS No. 33 income measures and that constraining these coefficients to be equal across industries will result in an inappropriate specification of the model. Unlike the previously discussed hypotheses, the null hypothesis that $\beta_1=\beta_2=\ldots=\beta_9=0$ can be rejected at the 0.10 level for only one of the regressions.

Based on the results of these hypotheses tests which suggest that there are significant differences across industries in the slopes of the SFAS No. 33 income variables and the cash flow variable, but not in the intercepts, we reformulate the model relating unexpected returns to unexpected price-change-adjusted earnings and cash flows as follows:

$$UR_{it}=\beta+\sum_{j=1}^{10}\gamma_j D_j U\Delta PCE_{it}+\sum_{j=1}^{10}\delta_j D_j U\Delta CF_{it}+\epsilon_{it}. \qquad (2)$$

Estimation results for equation (2) for each of the six SFAS No. 33 earnings variables using ordinary least squares estimation are reported in Table 4. The estimated coefficients and their corresponding t-statistics (in parentheses) are presented along with R^2s and F-statistics. The row labeled F(Regression) contains F-statistics for the overall regression and the rows labeled $F(\gamma_1=\gamma_2=\ldots=\gamma_9=0)$ and $F(\delta_1=\delta_2=\ldots=\delta_9=0)$ contain F-ratios for testing the null hypotheses that the coefficients of the SFAS No. 33 earnings variables and cash flow variable, respectively, differ across industries. The rows labeled $F(\gamma_1=\gamma_2=\ldots=\gamma_{10}=0)$ and $F(\delta_1=\delta_2=\ldots=\delta_{10}=0)$ report F-values for testing the null hypotheses that price-change-adjusted earnings and cash flow, respectively, convey incremental information over each other.

Several features of the results reported in Table 4 should be noted. First, the F-statistics for the overall regressions are significant for each of the six regressions at the 0.05 level of significance indicating that the independent variables as a group explain a significant portion of the variation in unexpected returns. The R^2s range from 0.077 to 0.163. Second, the F-ratios for testing the null hypothesis that $\gamma_1=\gamma_2=\ldots=\gamma_9=0$ are large enough to reject this hypothesis at the 0.10 level for four of the six regressions and those for testing the null hypothesis that $\delta_1=\delta_2=\ldots=\delta_9=0$ are significant at the 0.01 level for all six regressions. This suggests that there are significant differences across industries in the coefficients of the cash flow and SFAS No. 33 earnings variables, and that failure to allow for such differences will result in misspecification of the model.[12]

To test the hypothesis that a given unexpected SFAS No. 33 earnings variable conveys additional information over unexpected cash flow, we test the null hypothesis that $\gamma_1=\gamma_2=\ldots=\gamma_{10}=0$. The

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[12] Note that, both for the SFAS No. 33 earnings variables and cash flow variable, not all of the industries have positive coefficients. For CC, CCH, and CD, three of the ten industry coefficients were negative while more than three industries had negative coefficients for the other SFAS No. 33 variables. There were at least four industries with negative cash flow coefficients in each of the six regressions.

TABLE 4

REGRESSIONS OF UNEXPECTED RETURNS ON UNEXPECTED SFAS NO. 33 EARNINGS AND UNEXPECTED CASH FLOW

$(n=409)$

Equation (2): $UR_{it}=\beta+\sum_{j=1}^{10}\gamma_j D_j U\Delta PCE_{it}+\sum_{j=1}^{10}\delta_j D_j U\Delta CF_{it}+\epsilon_{it}$

Coefficient	SFAS No. 33 Earnings Measure					
	CC	CCP	CCH	CCPH	CD	CDP
γ_1	−0.225 (−0.805)	−0.318 (−1.301)	0.037 (0.447)	−0.053 (−0.530)	−2.615 (−4.282)	−1.610 (−3.597)
γ_2	0.161 (0.936)	0.111 (0.773)	0.039 (0.674)	0.027 (0.435)	0.285 (1.496)	0.218 (1.343)
γ_3	0.379 (0.729)	0.007 (0.034)	0.115 (0.657)	0.042 (0.194)	0.551 (1.370)	0.058 (0.216)
γ_4	−0.011 (−0.053)	0.031 (0.196)	0.036 (0.704)	0.027 (0.430)	0.178 (1.046)	0.140 (1.061)
γ_5	0.472 (2.993)	0.333 (2.608)	−0.012 (−0.283)	0.010 (0.175)	0.853 (4.417)	0.364 (2.440)
γ_6	0.193 (0.972)	0.143 (1.069)	−0.005 (−0.119)	0.001 (0.022)	0.230 (1.420)	0.161 (1.354)
γ_7	0.227 (1.502)	0.189 (1.906)	0.046 (1.163)	0.062 (1.149)	0.254 (2.029)	0.174 (1.937)
γ_8	0.166 (0.977)	0.037 (0.407)	0.049 (0.753)	−0.021 (−0.363)	0.211 (1.289)	0.068 (0.746)
γ_9	0.296 (1.675)	0.216 (1.322)	−0.114 (−1.499)	−0.020 (−0.228)	0.318 (1.901)	0.248 (1.417)
γ_{10}	−0.155 (−1.229)	−0.085 (−1.036)	0.002 (0.062)	−0.006 (−0.128)	−0.189 (−1.625)	−0.115 (−1.376)

Table 4—*Continued*

Coefficient	*SFAS No. 33 Earnings Measure*					
	CC	*CCP*	*CCH*	*CCPH*	*CD*	*CDP*
δ_1	0.323 (4.612)	0.340 (4.798)	0.312 (4.499)	0.302 (4.335)	0.406 (5.875)	0.405 (5.666)
δ_2	0.055 (0.997)	0.061 (1.072)	0.059 (1.068)	0.062 (1.105)	0.062 (1.160)	0.073 (1.318)
δ_3	0.033 (0.274)	0.085 (0.780)	0.061 (0.581)	0.066 (0.630)	0.055 (0.541)	0.079 (0.751)
δ_4	0.017 (0.369)	0.020 (0.455)	0.023 (0.498)	0.020 (0.443)	0.022 (0.499)	0.023 (0.508)
δ_5	−0.024 (−0.758)	−0.019 (−0.600)	−0.011 (−0.348)	−0.010 (−0.296)	−0.005 (−0.172)	−0.005 (−0.165)
δ_6	−0.009 (−0.218)	−0.000 (−0.003)	−0.006 (−0.137)	−0.004 (−0.106)	0.001 (0.034)	0.008 (0.197)
δ_7	0.012 (0.418)	0.019 (0.673)	0.026 (0.896)	0.019 (0.674)	0.019 (0.678)	0.022 (0.791)
δ_8	−0.016 (−0.356)	−0.025 (−0.558)	−0.015 (−0.330)	−0.018 (−0.394)	−0.007 (−0.173)	−0.020 (−0.441)
δ_9	0.020 (0.485)	0.026 (0.617)	0.007 (0.162)	0.008 (0.198)	0.027 (0.670)	0.031 (0.733)
δ_{10}	−0.012 (−0.450)	−0.017 (−0.639)	−0.016 (−0.594)	−0.015 (−0.581)	−0.020 (−0.785)	−0.022 (−0.844)
R_2	0.101	0.098	0.090	0.077	0.163	0.123
F(Regression)	2.183***	2.109***	1.929***	1.614***	3.768***	2.710***
$F(\gamma_1=\gamma_2=\ldots=\gamma_9=0)$	1.824*	1.904**	1.214	0.792	4.969***	3.139***
$F(\delta_1=\delta_2=\ldots=\delta_9=0)$	3.188***	3.431***	2.987***	2.722***	4.515***	4.334***
$F(\gamma_1=\gamma_2=\ldots=\gamma_{10}=0)$	1.855**	1.715*	1.376	0.782	4.840***	2.847***
$F(\delta_1=\delta_2=\ldots=\delta_{10}=0)$	2.885***	3.097***	2.692***	2.451***	4.071***	3.907***

* Significant at the .10 level.
** Significant at the .05 level.
*** Significant at the .01 level.
Notes: Figures in parentheses are t-statistics.
See Table 3 for variable definitions.

F-ratios reported in Table 4 indicate that, when price-change-adjusted earnings is measured as CD or as CDP, it is significant at the 0.01 level in explaining unexpected returns. The corresponding ratios for CC and CCP are significant at the 0.05 and 0.10 levels, respectively. These results indicate that certain measures of price-adjusted earnings reported under SFAS No. 33 convey incremental information over operating cash flow.

To test the hypothesis that unexpected cash flow has incremental information over a given unexpected earnings measure, we test the null hypothesis that $\delta_1=\delta_2=\ldots=\delta_{10}=0$. The *F*-ratios reported in Table 4 are all significant at the 0.01 level, indicating that there is information in cash flow beyond that contained in each of the SFAS No. 33 earnings measures.[13]

The results reported in this subsection indicate that when price-change-adjusted earnings are measured as CD, CDP, CC, or CCP, they convey incremental information over operating cash flow. The results also indicate that cash flow has incremental information over each of the six SFAS No. 33 earnings measures investigated. Finally, there are significant differences across industries in the relations between unexpected returns, unexpected price-change-adjusted earnings, and unexpected cash flow, and, contrary to expectations, some of the coefficients have negative signs.

Deletion of Outliers

Because the regression coefficient estimates reported in the preceding subsection may have been strongly influenced by extreme values of the independent variables, we reestimated equation (2) using a sample in which values of the independent variables which deviated from their corresponding means by more than four standard deviations were trimmed so that they equalled the four standard deviation limit. The results using this "trimmed" sample differed very little from those obtained with the "untrimmed" sample, suggesting that the primary results were not obtained because of the presence of a few extreme observations.

Weighted Least Squares Estimation

Because the variances of unexpected returns may differ across firms from different industries, ordinary least squares estimation will produce biased estimates of coefficient standard errors. This in turn will result in biased *t*- and *F*-statistics. To mitigate this problem, equation (2) was reestimated after weighting each observation by the inverse of the standard deviation of the ordinary least squares residuals from equation (2) for all the sample firms from its corresponding industry. This procedure adjusts for differences in residual variances across firms from different industries while assuming that firms within an industry have equal residual variances. The results of this procedure were very similar to the primary results reported earlier and indicate that the primary results were insensitive to differences in residual variances across firms from different industries.

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[13] Equation (2) was also estimated using unexpected returns for weeks -1 and $+1$. The explanatory power of the regressions using these unexpected returns was lower than that for the corresponding regressions using unexpected returns in week 0 as the dependent variable. Tests of the incremental information of cash flow hypothesis indicated rejection at the 0.10 level in all six regressions when unexpected returns measured in week -1 were used as the dependent variable. However, the incremental information of cash flow hypothesis could not be rejected for any of the six regressions when week $+1$ unexpected returns were used. Unlike the results obtained for the cash flow variable, only in one regression could the null hypothesis that $\gamma_1=\gamma_2=\ldots=\gamma_{10}=0$ be rejected when week -1 unexpected returns were used. However, when week $+1$ unexpected returns were used as the dependent variable, the null hypothesis could be rejected in three of the six regressions.

Tests of Incremental Information Using White's Covariance Estimator

The weighted least squares estimation procedure described in the preceding subsection assumes that error variances are equal across firms in a given industry. If error variances differ across firms in an industry, then ordinary least squares estimation and the weighted least squares estimation procedure described in the preceding subsection will produce biased and inconsistent estimates of coefficient standard errors. As a result, faulty inferences may be drawn when testing statistical hypotheses in the presence of such heteroscedasticity. Therefore, we tested the hypotheses that $\gamma_1 = \gamma_2 = \ldots = \gamma_{10} = 0$ and $\delta_1 = \delta_2 = \ldots = \delta_{10} = 0$ using White's [1980] general-heteroscedasticity-corrected covariance matrix estimates which are consistent in the presence of heteroscedasticity, but do not rely on a specific formal model of the structure of the heteroscedasticity. Once again, the results of tests of incremental information of SFAS No. 33 earnings and cash flows were, in general, consistent with those reported in the primary results.

IV. SUMMARY AND CONCLUSIONS

This study examined whether alternative measures of current cost and constant dollar income disclosed under SFAS No. 33 conveyed incremental information beyond that provided by historical cost income and its cash and accrual components. Unlike prior studies that assessed incremental information by examining lead associations between unexpected measures of these price-change-adjusted income variables and stock returns, the focus of this study was on contemporaneous associations. The research was designed to exploit the difference in timing between the release of historical cost earnings in *The Wall Street Journal* and the release of SFAS No. 33 earnings in the annual report or 10-K report.

The empirical analysis indicated that, when price-change-adjusted income was measured as constant dollar operating income (CD), constant dollar operating income plus purchasing power gain or loss (CDP), current cost operating income (CC) or current cost operating income plus purchasing power gain or loss (CCP) it had significant incremental information over cash flow. Significant incremental information was not observed when current cost operating income plus holding gain (CCH) or current cost operating income plus purchasing power gain or loss plus holding gain (CCPH) was used as the earnings measure. The results also indicate that cash flow conveyed significant incremental information over each of the six measures of price-change-adjusted earnings examined.

The empirical evidence also indicated that the relation between each SFAS No. 33 variable and unexpected returns was significantly different across industries. Similar results were obtained for the relation between cash flow and unexpected return. This suggests that cross-industry differences in these relations should be allowed for in cross-sectional studies of SFAS No. 33 data. Finally, it should be noted that, contrary to expectations, the signs of the coefficients of the SFAS No. 33 earnings variables and the cash flow variable were negative for some of the industries studied. This suggests that SFAS No. 33 earnings may convey incremental information only for a subset of industries.

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SMALL SAMPLE STUDIES

M. Edgar Barrett, Editor

Lessors' Accounting and Residual Values: Comdisco, *Barron's*, and GAAP

Marian Powers and Lawrence Revsine

ABSTRACT: Financial reporting of lessors' transactions is a controversial area for several reasons: (1) lessors' accounting alternatives (e.g., operating vs. sales-type lease methods) usually generate large financial statement differences; (2) many of the parameters required to implement lessors' accounting choices (e.g., residual value estimates) are "soft" and, therefore, difficult to verify; (3) little is known about the sensitivity of income disclosures to errors in these parameter estimates; and (4) lessors' rules are still evolving and, therefore, are somewhat ill-defined. Using a highly critical *Barron's* article regarding Comdisco, Inc. as a starting point, this paper analyzes aspects of these reasons for controversy, especially (3) and (4). Specifically, *Barron's* argued that Comdisco's accounting for residual values and other leasing income recognition procedures were flawed. Using Comdisco's financial reports as a benchmark, we analyze elements of lessors' accounting and evaluate competing reporting options. We then examine the sensitivity of income numbers to residual value estimation errors using a simulation approach. The parameters for the simulation are derived from Comdisco's recent disclosures. The simulation results and analysis are used as a basis for recommending changes in lessors' financial disclosures and income determination.

COMDISCO, INC. is a lessor of both mainframe computers and peripheral equipment. Comdisco purchases this equipment primarily from IBM and remarkets it using both operating and capital leases. The company is a full service lessor providing leases on both new and used equipment under a variety of financing arrangements. A discordant note regarding Comdisco's financial reports reverberated through the business community in October 1983,

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when *Barron's* published an article highly critical of Comdisco's accounting practices [*Barron's*, 1983].

That article focuses on the uncertainty regarding realization of estimated residual values and its impact on the amount and timing of income recognition. The *Barron's* author also criticizes Comdisco's inclusion of 100 percent of the proceeds from certain tax-advantaged transactions in income without first reducing its investment in the equipment. The author argues that Comdisco might not recover its remaining investment in its leased computer equipment and if the residual value were not realized, the company would have to take a writeoff adversely affecting income and stockholders' equity. The *Barron's* author states that "...if *all* equipment were considered to have zero residual value, Comdisco's entire net worth, as of the end of fiscal 1982, would vanish" [*Barron's*, 1983, p. 8].

Investor reaction to the *Barron's* article was swift. Using October 3 as a benchmark, Figure 1 compares Comdisco's cumulative return for the month of October 1983 with the S&P 500 cumulative return. In the week following publication of the *Barron's* article, Comdisco's share price dropped from $38.25 per share on October 7 to $22.88 per share on October 14, while the S&P stock index moved from 170.8 to 169.9 over the same time period.[1] In Figure 1 this pattern is exhibited as a drop from a +4 percent cumulative return on October 7 to a −38 percent cumulative return on October 14. Comdisco's share price dropped to a low of $8.75 in November 1984. Figure 2 summarizes movements in Comdisco's cumulative return from January 1983 through December 1985.

Some might interpret the market price reaction as evidence that *Barron's* uncovered something of substance regarding Comdisco's application of lessors' accounting for residual values and income recognition.[2] However, Comdisco had clearly not been violating generally accepted accounting principles governing lessors' accounting. Instead, Comdisco had been exercising the latitude that existed in lessors' accounting rules at the time of the *Barron's* article.

This paper uses the Comdisco events as a benchmark to critically evaluate lessors' accounting, especially in light of the high degree of uncertainty regarding realization of estimated residual values and the sensitivity of resulting profits to errors in residual realizations. It is not our intention to assess the historical accuracy of the *Barron's* article. Rather, *Barron's* raised a series of provocative accounting issues that have never been rigorously scrutinized. Our goal is to evaluate *contemporary* lessors' accounting and to use this analysis as a means for assessing the reasonableness of *existing* accounting principles and disclosure requirements for lessors' residual value sales and revenue recognition procedures. A simulation using estimated Comdisco data for key parameter values is used in reaching conclusions about the

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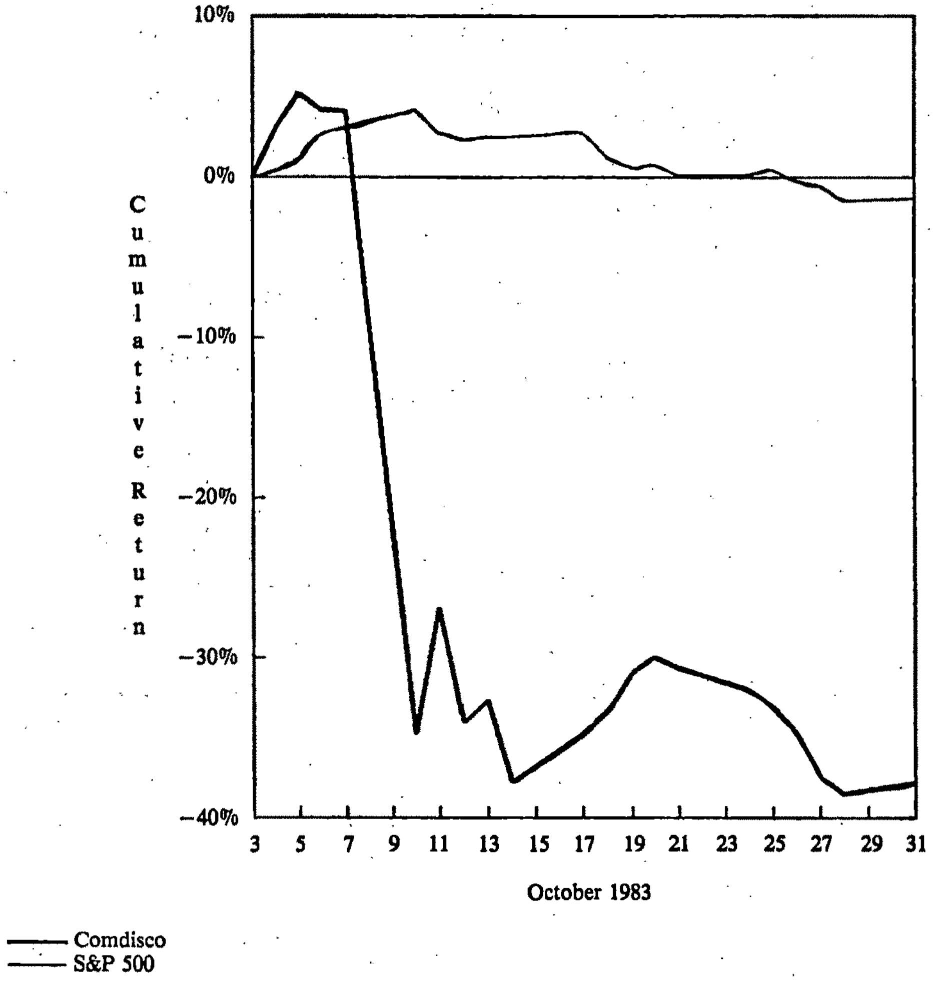
[1] Neither set of numbers is adjusted for dividends. However, Comdisco had no ex-dividend date in October, 1983. Therefore, the disparate return movements are slightly more extreme than depicted in Figure 1. Also, both share price and index values are the closing values for the day.

[2] *Barron's* enumerates several concerns about Comdisco which include (1) the future prospects for the computer leasing industry in the near term; (2) a new competitor (IBM) entering the leasing field and possibly hurting Comdisco's leasing business; (3) an IRS review of Comdisco's tax-advantaged transactions; and (4) Comdisco's existing lessor accounting. Whether or not the market price decline was due solely to the lessor accounting issues or to some of these other factors such as industry outlook is an empirical question. It is also one which would be difficult to test since Comdisco's publicly-held competitors are primarily subsidiaries of major corporations such as Bell Atlantic and IBM.

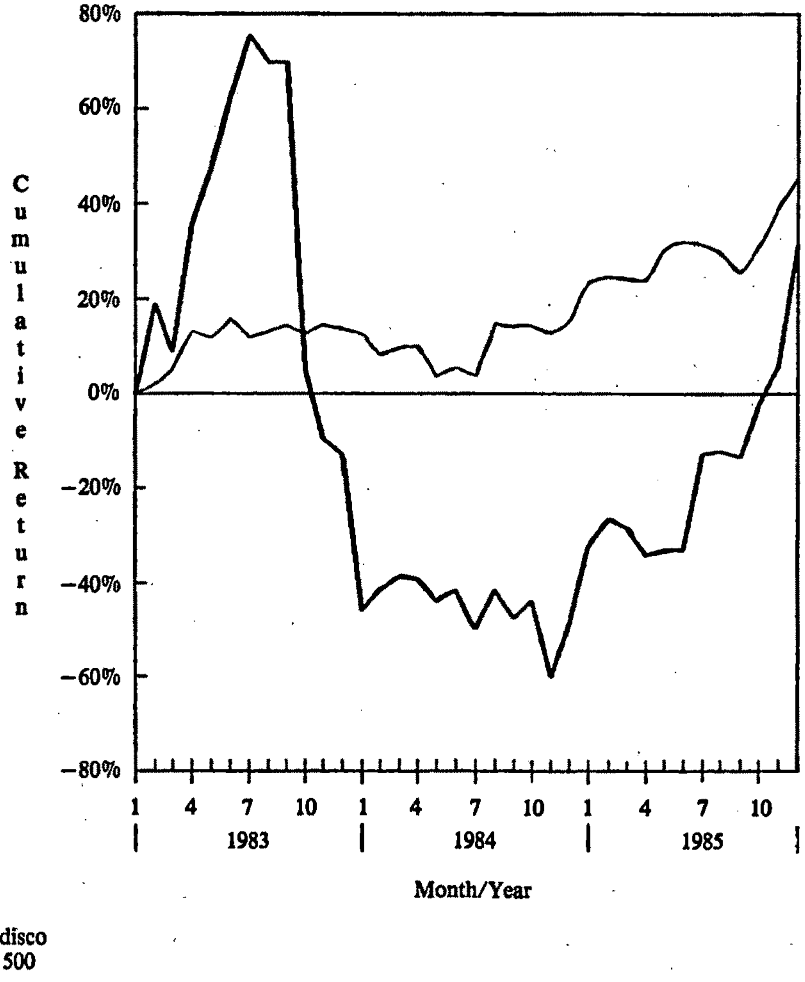
Figure 1
Cumulative Return
October 1983
Comdisco vs. S&P 500



adequacy of GAAP in these areas. Our data source is publicly available data (e.g., annual reports, 10-Ks, and data disseminated by Comdisco to the analyst community). While we have contacted Comdisco personnel, we sought clarification rather than additional information not readily available to outsiders.

Section I briefly reviews the existing theory underlying lessors' income recognition rules; Section II describes and illustrates elements of Comdisco's transactions and the *Barron's* article. In Section III we develop parameter estimates which are then used in Section IV in a series of simple simulations to examine the impact of errors in residual value estimates on lessors' net income. Section V provides further analysis and conclusions.

FIGURE 2
CUMULATIVE RETURN
JANUARY 1983 THROUGH DECEMBER 1985
COMDISCO VS. S&P 500



I. LESSORS' INCOME RECOGNITION CRITERIA UNDER GAAP

In general, the timing of revenue recognition and income recognition coincide in existing accounting practice but exceptions exist. For example, under both the installment sales and the cost recovery methods, revenue appears on the income statement in the period of the transaction, but the associated income is reflected only when "realized" in some later period. *Barron's* argues that the sale of equity interests (for both capital and operating leases) constitutes an unusual case in which revenue and income ought not to be recognized simultaneously. Indeed, this issue can be raised regarding lessor residual value realization in general. Therefore, it will be helpful for us to review the criteria for income recognition in detail.

Regrettably, the FASB's recognition and measurement statement [FASB, 1984] introduces criteria that are most applicable to cases in which revenue and income recognition are contemporaneous.[3] Little attempt has been made to develop general criteria which explain why *income* recognition is sometimes delayed beyond the time that the revenues are received.

Scrutiny of published summaries of financial reporting practices suggests that income is recognized when *both* of the following two *income recognition criteria*[4] are met:

(1) the "critical event" in the earning of the income has occurred [Myers, 1959], and
(2) the amount of earned income can be measured with a reasonable degree of assurance.

To illustrate the application of these criteria, income recognition is postponed to some period(s) after revenue recognition under both the installment sales and cost recovery methods because the second criterion has not been met. The high degree of uncertainty regarding the ultimate collectibility and, hence, the value of a note or other assets received in these transactions means that income *cannot* be measured with a reasonable degree of assurance at the inception of the transaction.

Notice that these two income recognition criteria parallel SFAS No. 13 [FASB, 1976] lessors' guidelines for distinguishing between operating and capital leases.[5] Specifically, the four SFAS No. 13 Group I criteria common to both lessors and lessees all represent instances in which valuable property rights have been transferred from the lessor to the lessee. It is the transfer of these property rights which the SFAS No. 13 guidelines treat as the "critical event" necessary for a "sale" of the asset (i.e., capital lease treatment). Furthermore, the two SFAS No. 13 Group II criteria unique to lessors together are equivalent to the second income recognition criterion (i.e., "the amount of earned income can be measured...").

The crux of the *Barron's* article involves this second income recognition criterion. Given the uncertainties regarding eventual residual values, the article is (implicitly) questioning whether the *amount* of income can, in fact, be measured with a reasonable degree of assurance at the inception of the leasing transaction. If potential residual value forecast errors make the degree of assurance too low, then, presumably, something akin to the cost recovery method would be more appropriate.[6] Indeed, existing practice does suggest the use of the cost recovery method when uncertainties regarding *receivables* collection are very high, for example, in franchise [FASB, 1981] and real estate [FASB, 1982] sales. The (again, implicit) rationale is that extreme collection uncertainty lowers the degree of assurance at the inception of the transaction regarding the amount of income that has been earned. However, SFAS No. 13 does not explicitly raise similar income recognition issues at the inception of a capital lease[7] with regard to potential misestimates of residual values.

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[3] The FASB proposes that recognition of revenues (and implicitly, income) should take place when the revenues are realized or realizable, and earned [FASB, 1984, par. 83].

[4] These criteria are widely cited (see, e.g., Granof [1985, p. 181]).

[5] These SFAS No. 13 [1976] guidelines fall into two groups. For a lease to be classified as a capital lease (thereby accelerating income recognition), at least one of the Group I criteria and *both* of the Group II criteria must be met.

The Group I criteria are:

1. The lease transfers ownership of the property to the lessee.
2. The lease contains a bargain purchase option.
3. The lease term is equal to 75 percent or more of the estimated economic life of the leased property.
4. The present value of the minimum lease payments equals or exceeds 90 percent of the fair market value of the leased property.

The Group II criteria are:

1. Collectibility of the minimum lease payments is reasonably predictable.
2. No important uncertainties surround the amount of unreimbursable costs yet to be incurred by the lessor under the lease.

[6] Using the cost recovery method, no profit is recognized until cash collections exceed cost of goods sold [Kieso and Weygandt, 1986, pp. 833–835].

Uncertainty regarding realization of residual values is not unique to lessors' accounting. The problem also exists for owned assets insofar as misestimates of useful life, depreciation pattern, and technological change necessitate eventual write-offs (which are essentially corrections of prior years' earnings). Three factors differentiate lessors' accounting from more "standard" depreciation/salvage value uncertainties:

1. Many of the parameters which guide lessors' choice of accounting method are "soft" and, therefore, difficult to verify (e.g., economic life, discount rate).
2. Lessors' capital lease accounting methods when compared with the operating lease method usually generate extremely large front-end financial statement differences.
3. These financial statement differences can be exacerbated by financing mechanisms commonly used by lessors and by the accretion of income[8] on the residual value over the lease term.

Thus, while the residual value uncertainty problem pervades existing accounting, the magnitude of the period-to-period differences and the absence of "objective" choice guidelines make the issue potentially severe in lessors' accounting.

II. *Barron's*, COMDISCO, AND ACCOUNTING FOR LEASES

In 1986, Comdisco, Inc. acquired approximately $1.3 billion in leasable assets. To finance the acquisition of such assets, the company discounted the lease rental payments and sold equity interests in the assets' residual value. We illustrate these two financing avenues sequentially. First, assume that Comdisco purchases computer equipment costing $1,000 with an expected useful life of six years. Comdisco negotiates a 4-year lease with a lessee for a specified series of lease payments. Subsequent to the inception of the lease, the lease payments to be received in the future are assigned to financial institutions on a non-recourse basis to Comdisco. This means that Comdisco immediately receives the present value of those cash flows, thereby recovering some of its cash investment.

Figure 3 depicts the event pattern for the example described above with specific dollar amounts included merely for illustrative clarity.

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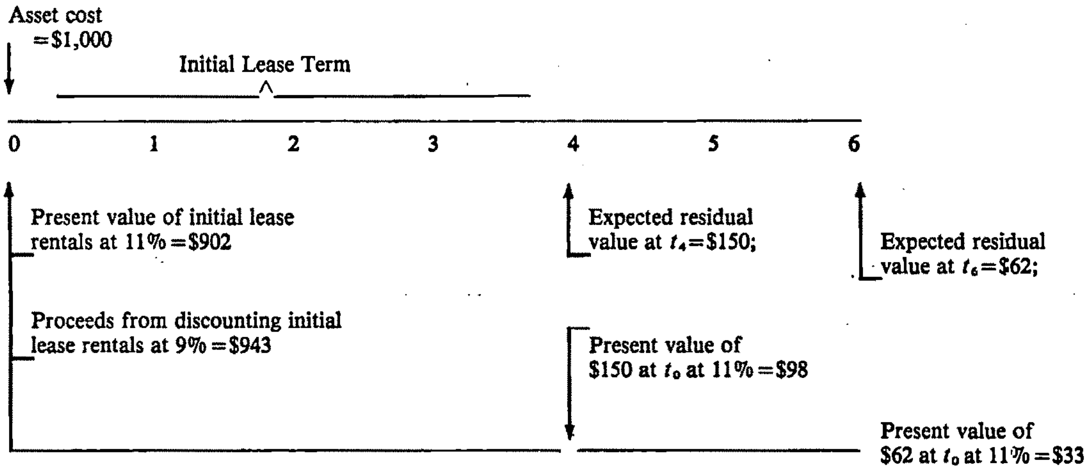
[7] However, subsequent to booking a capital lease, SFAS No. 13 requires a writedown of residual value if a permanent decline in value occurs. Specifically, the estimate of residual value pertaining to sales-type or direct financing type leases should be reviewed annually. If there has been a permanent decline in the residual value, the net investment in the lease should be reduced and a loss recognized to reflect the decline in value. No upward adjustment to the estimate of residual value is allowed.

Current disclosures make it difficult to discern whether companies are avoiding necessary writedowns since information about the amount of actual realization versus recorded residual value is not disclosed. This uncertainty regarding adherence to existing GAAP is especially true of growth-type companies that can offset losses on residual value realization against operating income (possibly overstated) from new leases. (However, in its 1986 annual report, Comdisco began providing helpful disclosures regarding residual values. See fn. 32.)

[8] This practice of accreting the residual value and recognizing income was restricted with the issuance of Technical Bulletin No. 034 [FASB, 1986]. For transactions entered into on or after June 18, 1986, if the lessor sells a direct interest in the lease rental payments (rather than merely a security interest), accretion of the residual value is prohibited.

FIGURE 3

LESSOR LEASE TRANSACTION WITH DISCOUNTING OF LEASE RENTAL PAYMENTS


Asset cost
=$1,000
Initial Lease Term
0
1
2
3
4
5
6
Present value of initial lease rentals at 11% = $902
Proceeds from discounting initial lease rentals at 9% = $943
Expected residual value at t_4 = $150;
Present value of $150 at t_0 at 11% = $98
Expected residual value at t_6 = $62;
Present value of $62 at t_0 at 11% = $33

In addition to augmenting cash flow, the assignment of lease rentals to a financial institution also affected[9] the lessor's income. If the bank's discount rate of interest (e.g., 9 percent) was lower than the return implicit in the capital lease contract (e.g., 11 percent), lessors such as Comdisco immediately recognized as income the difference between the present value of the rentals under the two different interest rates (i.e., $943 − 902 = $41).[10,11] At the end of the initial lease term, Comdisco could then either re-lease the asset or sell the asset and recognize the gain or loss on the difference between the equipment's realized market value and its book residual value.

Notice that the ultimate profit (if any) on these transactions depends upon two future events: (1) the ability to re-lease the asset during years 5 and 6, and/or (2) the amount of residual value actually realized at whatever time the asset is finally sold. Both of these events will be affected by future technological and other market changes that cannot be foreseen with perfect clarity at the time of the initial transaction. This uncertainty, especially regarding realization of future residual values, constitutes the major concern of both the *Barron's* article and this paper. The risk of income misstatement is further exacerbated by the accretion (accrual) of income on the residual value over the lease term. Accre-

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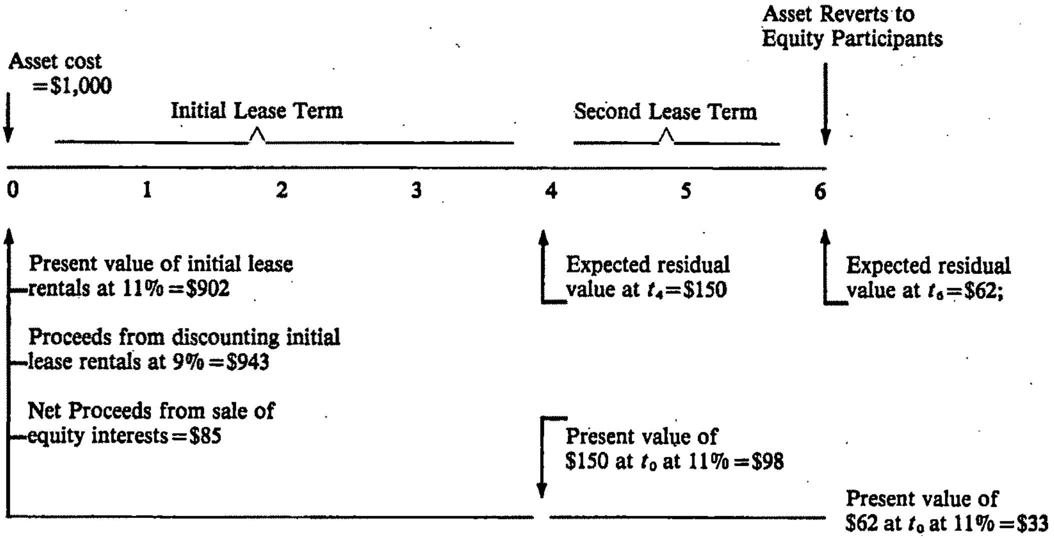
[9] We purposely use the past tense here because SEC [1987] has altered the financial reporting for such assignments (see Sec. IV).

[10] This financing arrangement is used for both operating and capital leases. However, the reporting of discounted lease rentals depends on lease classification. If the lease is an operating lease, discounted lease rentals are reported as a separate liability. For a capital lease, the discounted lease rentals were treated as a contra asset account reducing the receivable called net investment in capital leases. The issuance of Staff Accounting Bulletin No. 70 [SEC, 1987] altered the reporting of discounted lease rentals for capital leases. Specifically, if the discounting of lease rentals transfers a security interest (collateral) in the lease or leased asset then the discounted rentals must now be reported as a separate liability. Only if the transfer of lease rentals represents a direct interest (sale) in (of) the lease or leased asset is the offsetting of the discounted lease rentals against the lease receivable allowed.

[11] Beginning in 1987, lessors had to alter income recognition to conform with SEC Staff Accounting Bulletin No. 70 [SEC, 1987], that requires that the difference in present values be taken into income over the lease term when the lessor transfers only a security interest in the lease. Section IV details the changes in reporting and income recognition and incorporates them into the simulation analyses reported in Exhibits 3 and 4.

FIGURE 4

LESSOR LEASE TRANSACTION WITH DISCOUNTING OF LEASE RENTAL PAYMENTS AND SALE OF EQUITY INTERESTS


Asset Reverts to Equity Participants
Asset cost =$1,000
Initial Lease Term
Second Lease Term
0
1
2
3
4
5
6
Present value of initial lease rentals at 11% =$902
Proceeds from discounting initial lease rentals at 9% =$943
Net Proceeds from sale of equity interests=$85
Expected residual value at t_4=$150
Expected residual value at t_6=$62;
Present value of $150 at t_0 at 11% =$98
Present value of $62 at t_0 at 11% =$33

tion is an integral part of lessor accounting [FASB, 1976] as the simulations in Section IV illustrate. However, the primary purpose of the simulations is to analyze the sensitivity of the years 1 through 4 income measures in order to assess whether the income recognition criteria discussed in Section I are typically satisfied in such lessors' transactions.

Before analyzing the residual value uncertainty issue, consider a slightly more complicated version of the Figure 3 transaction. This overlay on the basic transaction, illustrated in Figure 4, allows Comdisco and other lessors to increase their up-front cash flows and, thus, further finance the acquisition of the leased asset. To illustrate, after "selling" the years 1 through 4 contractual rights to a financial institution, Comdisco might next sell asset title to a third party, retaining use of the asset through year 6 via a leaseback from the third party.

We examine these sale of equity interest transactions for three reasons. First, a portion of the proceeds from such sales were immediately recognized by Comdisco as profit; this profit was the focal point of the criticisms leveled by *Barron's*. Second, it will become evident that the accounting for these equity interest proceeds constitutes a special case of the residual value realization uncertainty that constitutes the central focus of this paper. Third, we believe that the theoretical issues raised by the equity interest sales are reasonably straightforward and can be settled before analyzing the residual value uncertainty issue itself.

As Figure 4 illustrates, we assume that this third party purchaser pays a net amount of $85 for this year 6 equity interest.[12] The investor receives as consideration: (1) the net present value (at time 0) of the year 6 residual value ($33),

[12] The mechanism for transferring the equity interests is a "wrap lease" transaction in which the lessor "sells" the asset to the third party investor and "leases" it back. In the context of the Figure 4 example, the present value of the sale proceeds from the third party would exceed the present value of "leaseback" payments by $85.

and (2) the tax benefits resulting from a timing difference ($52).[13] The key issue is what account(s) is (are) credited by the lessor at the time of cash receipt.[14]

Discerning Comdisco's original accounting for the proceeds from sales of residual values is not easy. According to *Barron's*, prior to mid-1982 Comdisco treated all fees (e.g., the entire $85) as income rather than as an offset to the asset account.[15] The apparent rationale for not reducing the asset's carrying value was that the two-year interval between the end of the initial lease term and the transfer to equity participants at the end of year 6 provided Comdisco with an opportunity to recover its remaining investment by generating additional lease rentals. Even after the asset reverted to the third party purchaser, Comdisco, for a fee, acted as a broker to either re-lease or sell the computer equipment. This service provided further investment-recovery potential.

However, the history of the computer leasing industry reveals that some lessors were unable to recover the full amount of their initial investment, thereby precipitating bankruptcy [Tannenbaum, 1981]. The lessors that experienced difficulties had underestimated the rate of technological change in the computer industry and had not only overestimated the useful life and residual value of the leased assets but often had liberal lease cancellation clauses. When it came time to re-lease these computers for the remainder of their expected useful life, the market for these now obsolete computers had evaporated.

Acknowledging the risks associated with technological obsolescence, Comdisco, in mid-1982, began a policy of deducting some portion of the $85 of fees revenues against its remaining investment for its mainframe computers (but *not* for peripheral equipment).[16,17] The company argued that a strong secondary market existed for peripheral equipment but not for the mainframes themselves. In effect, Comdisco recognized fee income either gross (i.e., for peripherals) or net after treating some portion of the proceeds as a reduction in residual value (i.e., for mainframe computers). Management justified this divergence because of differences in the risk of asset recovery arising from alternative secondary markets. However, this accounting policy was again changed by September 30, 1983.[18] In its annual report for that year, Comdisco disclosed that "the equity payment is first applied to remove a portion of the residual value"[19] presumably for

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[13] For tax purposes, when Comdisco sells and leases back the asset from its new owner, it forgoes the right to accelerated depreciation expense over the lease term; instead, it gets to deduct rent expense over the same period. As owner, the equity participant receives a tax benefit associated with the asset. Specifically, the equity participant receives rental income from Comdisco which is offset by accelerated depreciation expense. Hence, Comdisco is effectively selling a timing difference benefit along with a portion of the residual interest. In some cases, the equity participants also obtained investment tax credits.

[14] Arthur Andersen & Co. [1986, p. 65] describes the treatment of these transactions as follows: "accounting for lessor sales of residual values before lease termination is an evolving area that is not addressed in the accounting literature, and practice varies."

[15] *Barron's* [p. 20]. The only data available on Comdisco's 1982 accounting for sales of residual values are *Barron's* quotations attributed to a Comdisco spokesman. We presume those quotes to be accurate because the letter to stockholders from Comdisco's President (see fn. 17) doesn't challenge the accuracy of the quotes.

[16] *Barron's* [pp. 9, 20] quotes John Vosicky, Comdisco's Vice President for Accounting and Financial Controls, as acknowledging that Comdisco's accounting for fee revenues differed depending on whether the asset involved was peripheral or nonperipheral equipment.

[17] Letter from Kenneth N. Pontikes, Comdisco President, to Comdisco stockholders, dated October 12, 1983, pp. 4–5. This letter seemingly confirms the accuracy of the *Barron's* quotes regarding accounting for sales of residual values.

[18] Comdisco 1983 Annual Report, p. 26. The auditor's opinion carries the date November 9, 1983.

[19] Comdisco 1983 Annual Report, p. 35. Close scrutiny of the 1983 annual report strongly suggests that

all equity sales transactions. This accounting continued in subsequent years.

While the 1984, 1985, and 1986 annual reports make it clear that the (e.g.) year 4 residual value is reduced, the *amount* of the reduction is not specified.[20] To be theoretically defensible, the reduction in the present value of the year 4 residual value ($98) should encompass the entire present value of the year 6 residual value ($33) that has been sold to the third-party investor. The rationale for this procedure starts with the fact that the $98 represents the year 0 present value of all future net cash flows *expected* to be generated by the asset subsequent to year 4. These cash flows include all renewal rental proceeds as well as ultimate resale value. Since the lessor has just sold its right to all parts of the stream beyond year 6, the present value *to the lessor* of the $98 year 4 residual value has been reduced. The $33 is a measure of the reduction in this present value and, accordingly, ought to be subtracted from the initial residual carrying value to arrive at an adjusted year 4 residual value that reflects the equity sale. After reducing the residual value, the remaining portion of the fee ($52 for the tax benefits sold) could be treated as income of the sale period.

Thus, there is little, if any, justification for treating the gross inflows from sales of equity interests as income upon receipt. The sale of equity interests represents a "carve-out" of post-year 6 flows at a market-determined price. Offsetting the present value of these post-year 6 inflows ($33) against the present value of the year 4 residual value ($98) conforms to the economics of the transaction. Indeed, we believe that GAAP should prohibit lessors from treating gross proceeds from sales of equity interests as income. Instead, lessors should record the sale of equity interests as a debit to cash for the amount of sale proceeds (e.g., $85), a credit to the asset for the present value of the residual value sold (e.g., $33), and a credit to income for the difference between the proceeds received and the present value of the residual sold (e.g., $52).[21] Arithmetically, the failure to reduce the asset carrying value for the present value of the year 6 residual value (which was sold) simply increases the magnitude of subsequent adjustment if the higher residual value is not achieved.[22]

III. PARAMETER ESTIMATION FOR SIMULATION ANALYSIS

To examine the propriety of lessors' accounting in light of the uncertainty surrounding realization of residual values, we develop a prototype "typical" leasing transaction for capital leases.[23] The char-

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Comdisco did not retroactively change its accounting for the sales of residual values. Instead, it chose to change its accounting for all transactions on a *prospective* basis. Our reasoning is as follows. The 1983 annual report does not disclose any cumulative effect of the change in the accounting principle for reflecting profits on equity sales transactions. Two possible explanations exist: (1) the impact of the change on 1983 income was not material, or (2) the change in principle was adopted prospectively. Since the first explanation is at variance with our intuitive understanding of the magnitude of the income differences involved in the change, we are led to accept the second explanation.

[20] Comdisco Annual Reports: 1984, p. 22; 1985, p. 22; and 1986, p. 25.

[21] Interestingly, the FASB's staff is considering an even more extreme alternative. In FASB [1988], the staff proposes that (using our Figure 4 numbers) the entire $85 be deferred and included in income over the period of the "wrap lease" transaction. The rationale is that the "wrap lease" ought to be treated as a sale-leaseback in which profits are amortized over the life of the sale-leaseback transaction.

We believe that this proposal is too extreme. It ignores the substance of this type of "wrap lease," which simply transfers the residual value and the tax benefits to the third-party investor. Along with some members of the Emerging Issues Task Force [FASB, 1988, par. 32], we believe that the $52 proceeds from sale of tax benefits can appropriately be included in income at the time of sale.

[22] A demonstration is available from the authors.

[23] Our analysis of residual value errors is limited to capital leases. We adopt this focus for two reasons. First,

acteristics of a "typical" lease are derived from disclosures contained in Comdisco's 1986 annual report and Form 10-K. These prototype transaction characteristics become the parameters for simple simulation analyses to assess the relation between errors in residual value realizations and errors in resulting net income.

The analysis focuses on capital leases, in part because capital leases represent a majority of the dollar value of Comdisco's lease transactions. Direct disclosure of the relative proportions of capital and operating leases was not available in either the 1986 annual report or Form 10-K because the company netted proceeds from discounted leases against the balance sheet account "Net investment in sales-type and direct financing leases." Consequently, simple comparisons between the amount of that account and the leased equipment account (e.g., operating lease assets) would be misleading.[24] Therefore, in order to estimate the percentage of each type of lease, a more complicated computation incorporating disclosures both from the Statement of Changes in Cash and Form 10-K Schedules V and VI is applied. Using this procedure, we estimate that approximately 55 percent of the dollar value of equipment purchased in 1986 was devoted to capital leasing activites (the comparable figure for 1985 was 60 percent).[25]

The parameters for a prototypical capital lease transaction are: (1) the term of the average capital lease, (2) the average rate of return earned on such leases, and (3) the ratio of estimated ultimate residual value to original cost of the capital leased asset. Regrettably, none of these crucial parameter values has been directly disclosed by Comdisco. Therefore, each is estimated based on a series of assumptions or computations from available alternative disclosures.

Average term. SFAS No. 13 requires lessors to disclose a separate schedule of minimum lease payments receivable for both capital and operating leases. The payments must be broken-out by year for the ensuing 5 years and may be aggregated for all subsequent years. Comdisco's 1986 annual report disclosure shows no scheduled lease receipts due after the fifth year. Therefore, we assume that no capital leases extend beyond 5 years.

To determine the estimated average term of the average capital lease, we

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the residual value estimate is an important determinant of the rate of return on a capital lease (and, indeed, often influences whether the lease can be categorized as a capital lease in the first place). Since the accounting for capital leases front-end loads income *vis-á-vis* the accounting for operating leases, it seems important to investigate the impact of residual value errors in the more "aggressive" setting. Second, errors in residual value estimates for operating leases raise essentially the same issues as errors in capital leases.

[24] SEC [1987] now makes this comparison more informative. Thus, our estimation procedure is no longer necessary when only a security interest is transferred.

[25] The determination of this 55 percent figure is as follows: In the cash flow statement, Comdisco reports a 1986 "cost of equipment acquired for lease and inventory" of $1,319 million. Form 10-K Schedule V (Property, Plant, and Equipment) discloses an increase in gross leased equipment (i.e., the amount devoted to operating leases) of $635 million. Since $635,000,000/$1,319,000,000 =48.1%, our first estimate of the proportion of total acquisitions devoted to operating leases is 48.1 percent.

However, a complication arises. Computers coming off operating leases are transferred to inventory until such time as a new operating lease is written. Such transfers at net book value to inventory per Schedules V and VI totalled $83.5 million during 1986. Schedule V is ambiguous regarding whether the $635 million "additions at cost" include any re-transfers back from inventory to property, plant, and equipment. If they do, then the 48.1 percent provides an upwardly biased estimate of the proportion of new equipment devoted to operating leases in 1986. Assuming that all of the net out-transfers of $83.5 million were ultimately re-leased (and, thus, transferred back into the leased equipment account in 1986), the computation becomes ($635 − $83.5/$1,319) = 41.8%. This is a downwardly biased estimate of the desired proportion. Since the range of operating lease estimates is between 41.8 percent and 48.1 percent, we used 45 percent operating leases and 55 percent capital leases as our estimate.

compute the first differences of the 5-year schedule provided in the annual report. The first difference (e.g., the decline in the minimum payment for 1987 compared to 1988) gives an immediate number for payments of just 1 year's duration. Similar computations allow determination of the dollar amount of 2-year duration flows, 3-year, and so on. Multiplying these first differences by the number of years' duration and dividing by the initial dollar flow for 1987 provides a rough estimate of average term, 3.2 years.

This result is a downwardly biased estimate of the real duration of the typical capital lease since our estimation procedure treats the first difference (i.e., 1987 vs. 1988) as resulting from 1-year leases. In reality, a portion of this decline arises because some 2-, 3-, and 4-year leases will just happen to expire in 1988. Similar distortions exist for all subsequent first differences. Because of this downward bias, we use an average lease term of 4 years (rather than 3.2 years) in our example of the prototype capital lease transaction.

Average rate of return. Computing the average rate of return on capital leases also necessitates complex inferences. One approach (precluded due to absent disclosures) would be a computation of average accounting rate of return on capital leases. However, segment data do not provide a breakdown by lease classification; hence, income data for the rate of return computation are unavailable. Furthermore, discounted leases are offset against the net investment in capital leases accounts, thereby precluding accurate assessment of the investment base necessary for computing rate of return. Even if the numerator and denominator data were available, the well-known disparities between one-period accounting returns and internal (time-adjusted) rates of return would pose further dilemmas [Solomon, 1966].

Comdisco's average rate of return is computed from residual value disclosures. Note 3 to the 1986 Comdisco financial statements discloses the following for capital leases:

	1986
Estimated residual values	$119,500,000
Less: Unearned revenue on residuals	28,900,000

The difference between these two numbers ($90,600,000) is the present value of the residual values *discounted at the average rate of return that constitutes the object of our inquiry*. Note 5 in the financial statements provides the following additional information:

Projected Net Book Value at Lease Termination

Years Ending September 30	*Sales-Type and Direct Financing*
1987	$ 26.9
1988	29.4
1989	19.4
1990	21.7
1991	22.4
	$119.5

By trial and error, the average discount rate which equates the year-by-year projected net book values at lease termination to $90,600,000 (the Note 3 present value) can be determined. This rate is 10.66 percent, and is rounded to 11 percent and used as our estimate of the prospective return on capital leases.

Estimated residual value as a percent of original cost. Once again, Comdisco has not provided direct disclosures for either component of this relation. Note 3 reports the balance of minimum capital lease payments *net of amounts discounted with financial institutions*. This balance does not approximate the original cost of the leased asset since (1) the disclosed minimum lease payments are net of discounted leases and, therefore, omit important investment segments, and (2) the disclosed minimum lease payments consist of the remaining balance of payments to be received on these leases, not the total minimum lease payments at the inception of the lease. Furthermore, the *un*discounted numbers for estimated residual values provided in Note 3 are reduced for sales of equity interest in the capital leased assets and, therefore, do not represent the entire residual value estimate at the inception of the lease.

Since we have been unable to find any disclosures which overcome these deficiencies, we are compelled to estimate the residual value to cost ratio using operating lease data. Note 4 provides a total for original (undepreciated) cost of equipment under operating leases ($1,350,800,000). This same note also provides a schedule of book value at lease termination ($184,800,000). These figures result in a residual value ratio of 13.7 percent of original cost ($184,800,000/$1,350,800,000). This result averaged with the 1985 estimate (15.6 percent) gives a rounded average of 15 percent which we used for the prototype lease transaction.[26]

IV. THE PROTOTYPE CASES

Direct Financing Leases

Table 1 provides the numeric basis for the simulation analyses regarding direct financing leases. The cost of the leased asset is assumed to be $1,000; all other figures are then set using the relationships derived in Section III. Specifically, the prototype lease runs 4 years, the estimated residual value as a percentage of original cost is 15 percent, and the year-by-year inflows are chosen to achieve a target return of 11 percent.

Since the focus of this paper is on the accounting impact of errors in lessors' residual value estimates, we use the prototype case to examine the magnitude of the effects of such errors on resulting financial statements. Because our initial parameter values are estimates derived from limited disclosures, we first indicate the impact on net income of joint errors in estimating both prototype parameters and residual values. These are:

1. The *shorter* is the life of the lease (e.g., 3 years vs. our estimated 4 years), the larger is the percentage impact on net income of an error in estimating ultimate residual value.
2. The *lower* is the rate of return (e.g., 9 percent vs. our estimated 11 percent), the larger is the percentage impact on net income of an error in estimating ultimate residual value.
3. The *larger* is the initial estimate of residual value as a percentage of cost (e.g., 20 percent vs. our estimated 15 percent), the larger is the percentage impact on net income of an error in estimating ultimate residual value.

Table 1 compares the *ex ante* computation of net income by year under the

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[26] This estimate could be downwardly biased if Comdisco sold equity interests in the operating leased assets. Like the capital lease disclosures, the reported operating lease undiscounted residual values are reduced, in some cases, for the sale of equity interests in the residual value. (We summarize the effect of parameter misspecification on our analysis in Sec. IV.)

In addition, the possibility exists that the ratio (estimated residual value as a percent of original cost) computed for operating leases may not be the same as the ratio we originally sought for capital leases. Indeed, a Comdisco employee indicated to us that finance lease residuals tend to be a lesser percentage of original cost than are operating lease residuals. However, in the absence of additional disclosures, we are forced to presume that the operating lease ratio is a tolerably accurate surrogate for the absent data on capital leases.

TABLE 1

IMPACT OF ERRORS IN LESSORS' RESIDUAL VALUE ESTIMATES FOR A DIRECT FINANCING LEASE

Residual Value Realized (Percent of Original Cost):			*15%*		*10%*		*0%*		*25%*	
Basic Case			*Cost $1,000—Realized Residual $150*		*Cost $1,000—Realized Residual $100*		*Cost $1,000—Realized Residual $0*		*Cost $1,000—Realized Residual $250*	
Cost $1,000—Estimated Residual $150										
Year	*Cash Flows*	*Income*	*Income*	*Percent Error*	*Income*	*Percent Error*	*Income*	*Percent Error*	*Income*	*Percent Error*
0	$ −1,000									
1	291	$110.71	$110.71	0	$ 95.90	−13.4%	$ 63.64	−42.5%	$138.19	24.8%
2	291	90.75	90.75	0	77.19	−14.9	49.17	−45.8	117.08	29.0
3	291	68.58	68.58	0	56.69	−17.3	33.78	−50.7	93.04	35.7
4	441	43.96	43.96	0	34.21	−22.2	17.41	−60.4	65.69	49.4
		$314.00	$314.00		$263.99		$164.00		$414.00	
Fourth year income if residual value error is first discovered in fourth year and the entire difference is run through income immediately			43.96	0	−6.04	−113.7	−106.04	−341.2%	143.96	227.5%

prototype lease with various levels of residual value realization. To illustrate, the income numbers in the 15 percent columns equal those in the *ex ante* columns (BASIC CASE) since 15 percent is the prototype residual value/cost percentage. As a further example, the 10 percent columns assume residual value realization is only $100, or 10 percent of the asset cost. These columns show what the net income numbers should have been given perfect *foreknowledge* of the ultimate residual value (10 percent), as well as the percentage deviation between the originally estimated residual value (15 percent) and the perfect foreknowledge numbers. Thus, if the lessors had known in advance that the ultimate realization would have been only 10 percent of original cost, then the income stream over the 4 years would have been lower than income assuming a 15 percent residual.[27] For example, year 4's net income from the lease should have been $34.21, which is 22.2 percent lower than the *ex ante* income of $43.96.

While informative, this percentage error is also somewhat unrealistic. In the real world, residual value realization errors presumably arise because of unforeseen technological changes. Hence, such "errors" would usually not be known as early as year 1. If the technological change is first recognized only in year 4 (at the end of the initial lease term), the "4th year error" row in the 10 percent column indicates that the *ex ante* reported income number would be reduced by 113.7 percent if the residual value was only 10 percent *and* this change was first discovered only in year 4. The 0 percent column 4th year error row indicates the worst possible case in which the leased asset has no residual value.[28]

Table 1 shows the income effect of residual value estimation errors for a single lease over time. Aggregating across all leases, the direction and magnitude of the income effect over time will vary depending on whether the lessor is experiencing growth, stability, or contraction in the real volume of lessor transactions. To discuss these different possibilities, it is useful to partition income into operating income and gains (losses) on residual value realizations. Table 1 shows that operating income is highest in year 1 and declines thereafter. If residual values are misestimated, any gain (loss) would need to be recognized at the end of the lease.

For purposes of illustration, assume a worse case in which estimates of residual value are systematically biased upwards for all lease transactions. In the single lease example, operating income is overstated during the lease term but a loss would be recognized in the fourth year due to the failure to realize the estimated residual value. For a high growth lessor which is not only replacing expiring leases but adding to the total base of lessor activity, operating income from new and existing leases is overstated and growing each year. When the growth rate is high, the overstated operating income can exceed any losses on realization of residual value.

If the real volume of lessor transactions is declining, operating income will decline because the company cannot or does not replace existing leases as they expire. Overall income may be negative in extreme cases because losses on residual value realizations can swamp operating income. For a steady-state lessor, results between the growth and contraction cases would be expected.

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[27] Of course, if the ultimately realized residual value were in fact known at the inception of the lease, a different implicit interest rate would have been applied.

[28] We include this case only because the *Barron's* author alluded to an analogous scenario, not because it is necessarily realistic.

Since GAAP does not require disclosures regarding actual versus expected residual value realizations, a lessor's failure to recover the estimated residual value may go unnoticed by the analyst until the lessor starts reporting overall losses.[29] Timely disclosures of residual value realizations would seemingly improve investors' assessments of the risks associated with lessors' activities.

Direct Financing Leases with Discounting

Table 2 is designed analogously to Table 1 and represents an extension of the prototype case; in Table 2, we assume that the lessor assigns the lease proceeds to a financial institution. Leveraging the transaction in this manner has been common in the industry; for example, the 1986 Comdisco annual report states that Comdisco "assigns the rentals of *most* leases to financial institutions at fixed interest rates on a nonrecourse basis" [p. 25, emphasis added]. Since lessors (including Comdisco) typically retain the interest in the residual value, we again explore the income impact of errors in residual value realization.[30] Table 2 indicates that leveraging the transaction considerably increases the error rate when the assumed residual value is not realized. For this reason, both the FASB [1986] and the SEC [1987] subsequently acted to alter elements of the accounting used in Table 2. Thus, Table 2 no longer constitutes GAAP and is included both for completeness and to illustrate the rationale for these recent accounting changes.

Prior to the changes, when lessors assigned the lease proceeds to financial institutions, the transaction was frequently accounted for as a "sale." This meant that income was recognized at the time of assignment equal to the difference between (1) the present value of the lease rentals at the lessor's implicit rate of return, and (2) the present value of the rentals at the (often lower) discount rate charged by the financial institution. Furthermore, the lessor was allowed to accrue interest on the residual value of the asset even though the lease proceeds had been sold.

In Table 2, the column percentage errors represent the somewhat unrealistic case in which perfect foreknowledge income numbers are compared with originally determined income numbers (BASIC CASE) computed using a presumed 15 percent residual value realization. The fourth year error row shows the percentage deviation if the residual value realization error is discovered in the fourth year and is included in that year's income in its entirety. A comparison of Table 2 with Table 1 illustrates the increase in the percentage impact of residual value errors when the basic transaction is leveraged. Specifically, the fourth year impact of realizing a 10 percent residual value on an *un*discounted lease is 113.7 percent (Table 1), while the same 10 percent residual value realization increases the percentage income error to 334.4 percent on a discounted lease (Table 2).

The SEC [1987] believes that many of these discounted lease transactions are effectively nonrecourse borrowings collateralized by the lease contract and/or by the leased asset itself; consequently,

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[29] Presumably, auditors would detect a continuing bias; however, existing audit procedures for residual values are not precise.

[30] We are unable to determine the average discount rate charged by the financial institutions to which Comdisco assigns lease proceeds. Accordingly, in Table 2 we have to assume a discount rate. The assumed rate is 9 percent which is 2 percentage points lower than the 11 percent estimated return being earned by Comdisco. This lower rate is based upon our presumptions that (1) the financial institutions have access to lower cost funds than does Comdisco, and (2) only lessees with the strongest credit ratings will be accepted by the financial institutions.

TABLE 2

IMPACT OF ERRORS IN LESSORS' RESIDUAL VALUE ESTIMATES FOR A DIRECT FINANCING LEASE AND SUBSEQUENT ASSIGNMENT OF LEASE RENTAL PRIOR TO SEC SAB NO. 70 [1987]

Residual Value Realized (Percent of Original Cost):			*15%*		*10%*		*0%*		*25%*	
Basic Case			*Cost $1,000—Realized Residual $150*		*Cost $1,000—Realized Residual $100*		*Cost $1,000—Realized Residual $0*		*Cost $1,000—Realized Residual $250*	
Cost $1,000—Estimated Residual $150										
Year	*Cash Flows*	*Income*	*Income*	*Percent Error*	*Income*	*Percent Error*	*Income*	*Percent Error*	*Income*	*Percent Error*
0	$−1,000.00 +942.76									
1	0	$52.23	$52.23	0	$18.74	−64.1%	$−57.24	−209.6%	$112.31	115.0%
2	0	12.11	12.11	0	7.29	−39.9	0	−100.0	23.43	93.3
3	0	13.46	13.46	0	7.99	−40.7	0	−100.0	26.67	98.1
4	150	14.95	14.95	0	8.75	−41.5	0	−100.0	30.35	103.0
		$92.75	$92.75		$42.77		$−57.24		$192.76	
Fourth year income if residual value error is first discovered in fourth year and the entire difference is run through income immediately			14.95	0	−35.05	−334.4	−135.05	−1003.3	114.95	668.8%

removing both the asset (the lease receivable) and the liability (the nonrecourse borrowing) from the balance sheet violates the general accounting prohibition against offsetting liabilities against assets. The SEC now permits this offset only when the transaction is a true sale, that is, when there is a "transfer from one party to another of a *direct interest* in a contractual right or property, and not a *security interest* in a right or property" [SEC, 1987, emphasis added]. Since most of these transactions are structured as borrowings for tax purposes (and, thus, transfer to the financial institution only a security interest in the lease and/or the asset), discounted lease accounting has been restricted. To remove the lease receivable and the nonrecourse borrowing from the balance sheet subsequent to the SEC [1987] action, the lessor must also be willing to recognize a taxable gain on the transfer of the direct interest to the financial institution.

The SEC [1987] action affects the income recognition of discounted lease transactions. Only when the lessor transfers a *direct interest* in the lease or leased asset is the receivable removed and a sale recognized in accordance with FASB [1983, par. 6]. However, if the lessor transfers only a *security interest* in the lease or leased asset, then the receivable remains on the books and a liability is recognized. For the security interest case, any spread between the discount rate and the lessor's implicit rate of return will be included in income over the lease term (rather than immediately) as the interest on the loan accrues and interest income is earned.

Comdisco's discounted leases are structured as borrowings for tax purposes and, hence, transfer only a security interest in the lease rentals and leased asset. Subsequent to SEC [1987], if lessors like Comdisco continue to structure their discounted leases in this manner in order to obtain the associated tax treatment, the income recognized in year 1 will be limited to the net interest earned in year 1 instead of the entire discounting profit. Table 3 represents a discounted lease transaction which transfers only a security interest in the lease rentals. As such, Table 3 is identical to Table 2 except that income from transferring a security interest in the lease rentals is spread over the lease term. To illustrate the impact of errors in residual value realization under this new scenario, compare the fourth year income impact of a 10 percent residual value realization shown in the two tables. The percentage income error decreases from 334.4 percent to 150.9 percent. As expected, the more conservative income recognition reduces the percentage income error of realizing a lower than expected residual value. However, the 150.9 percentage error on this is still higher than the comparable error of 113.7 percent on the undiscounted lease in Table 1.

Our final simulation examines the income impact of misestimates of residual values when the lessor transfers a direct interest in the lease rentals. Apparently cognizant that errors in residual value estimates have a substantially greater impact on income when a lessor sells the lease rental payments, the FASB issued a Technical Bulletin [FASB, 1986] which prohibits lessors from accruing interest on the residual value of a sales-type or direct financing lease when a direct interest in the lease rentals is transferred. Thus, the pre-1986 industry-wide accounting for sale of lease rentals (i.e., the Table 2 approach) has been changed.[31] Table 4 is identical to Table 2

[31] Since Comdisco's discounted leases transfer only a security interest in the lease rentals and the leased asset, Technical Bulletin No. 034 [FASB, 1986] has not affected Comdisco's accounting.

TABLE 3
IMPACT OF ERRORS IN LESSORS' RESIDUAL VALUE ESTIMATES FOR A DIRECT FINANCING LEASE AND SUBSEQUENT TRANSFER OF A SECURITY INTEREST IN THE LEASE RENTALS

Residual Value Realized (Percent of Original Cost):			*15%*		*10%*		*0%*		*25%*	
Basic Case			*Cost $1,000—Realized Residual $150*		*Cost $1,000—Realized Residual $100*		*Cost $1,000—Realized Residual $0*		*Cost $1,000—Realized Residual $250*	
Cost $1,000—Estimated Residual $150										
Year	*Cash Flows*	*Income*	*Income*	*Percent Error*	*Income*	*Percent Error*	*Income*	*Percent Error*	*Income*	*Percent Error*
0	$-1,000.00 +942.76									
1	0	$25.86	$25.86	0	$11.05	-57.3%	$-21.21	-182.0%	$ 53.34	106.3%
2	0	24.46	24.46	0	10.90	-55.4	-17.12	-170.0	50.79	107.6
3	0	22.51	22.51	0	10.62	-52.8	-12.29	-154.6	46.97	108.7
4	150	19.93	19.93	0	10.18	-48.9	-6.62	-133.2	41.66	109.0
		$92.76	$92.76		$42.75		$-57.24		$192.76	
Fourth year income if residual value error is first discovered in fourth year and the entire difference is run through income immediately			19.93	0	-30.07	-150.9	-130.07	-652.6	119.93	601.8%

TABLE 4

IMPACT OF ERRORS IN LESSORS' RESIDUAL VALUE ESTIMATES FOR A DIRECT FINANCING LEASE AND SUBSEQUENT TRANSFER OF A DIRECT INTEREST IN THE LEASE RENTALS

Residual Value Realized (Percent of Original Cost):			*15%*		*10%*		*0%*		*25%*	
Basic Case			*Cost $1,000—Realized Residual $150*		*Cost $1,000—Realized Residual $100*		*Cost $1,000—Realized Residual $0*		*Cost $1,000—Realized Residual $250*	
Cost $1,000—Estimated Residual $150										
Year	*Cash Flows*	*Income*	*Income*	*Percent Error*	*Income*	*Percent Error*	*Income*	*Percent Error*	*Income*	*Percent Error*
0	$−1,000.00 +942.76									
1	0	$39.95	$39.95	0	$12.09	−69.7%	$−57.24	−243.3%	$ 91.72	129.6%
2	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0
4	150	52.82	52.82	0	30.67	−41.9	0	−100.0	101.04	91.3
		$92.77	$92.77		$42.76		$−57.24		$192.76	
Fourth year income if residual value error is first discovered in fourth year and the entire difference is run through income immediately			52.82	0	2.81	−94.7	−97.19	−284.0	152.81	189.4%

except that income on the discounted leases is computed without accretion on the residual value over the lease-term because it is assumed that the lessor transfers a direct interest in the lease rentals. In Table 4, the percentage income errors associated with errors in residual value realization are reduced. For example, if the residual realization is only 10 percent of original cost (rather than the BASIC CASE's 15 percent presumption), then the income error drops from 334.4 percent in Table 2 to 94.7 percent in Table 4. Notice, however, that the error level remains high despite the more conservative income paradigm which prohibits accretion of the residual value.

To summarize, the simulation results show that the percentage income errors arising from misestimates of residual value are not small (Table 1). Before recent changes, lessors who discounted lease rentals with a financial institution were permitted to treat the transfer of interest in the lease rentals as if it were a sale and, also, to simultaneously accrete the residual value on the leased asset. In this setting, the percentage income errors arising from misestimates of residual value increased substantially (Table 2). The simultaneous dual income enhancement of Table 2 is no longer allowed. SEC [1987] and FASB [1986] now compel lessors to treat front-end loading of discounting income and residual value accretion as mutually exclusive alternatives. When the lessor merely transfers a security interest in lease rentals (i.e., no "sale" takes place), income from discounting is recognized over the lease term (rather than being front-end loaded) and accretion of the residual value continues. The resulting impact on income from misestimates of residual values has been mitigated (Table 3) but these error percentages continue to be greater than those on an undiscounted lease (Table 1). Finally, following Technical Bulletin No. 034 [FASB, 1986], when a lessor transfers a direct interest in the lease rentals (i.e., a "sale" takes place), the asset can be removed from the balance sheet and income recognized immediately but accretion on the residual value is not allowed. Table 4 shows that this approach merely brings the error rate back to a level roughly equal to the error rate on undiscounted leases.

V. FURTHER ANALYSIS AND CONCLUSIONS

Our conclusions regarding lessors' financial reporting encompass both the appropriateness of existing accounting rules as well as the adequacy of existing disclosure requirements.

The simulation results in Section IV illustrate the extreme sensitivity of net income to errors in residual value realizations. As Tables 1 and 2 indicate, this sensitivity exists in the basic capital lease case and becomes even more pronounced when the lease flows are discounted ("sold") to a financial institution and accretion of residual value is allowed. Table 4 shows that the FASB [1986] moved in the right direction since the error rates for discounted leases drop when the lessor is prohibited from accreting residual values. Table 3 reveals that the error rates also drop when income from transferring a security interest in the lease rentals to a financial institution is recognized over the lease term following SEC [1987]. However, because accretion of residual value continues when only a security interest is transferred, the drop in error rates is not as great as that observed in Table 4.

While the error rates in Tables 3 and 4 are lower than in Table 2, they are still high in an absolute sense. Thus, it is not clear to us that FASB [1986] and SEC

[1987] have gone far enough. Given the uncertainties and sensitivities of residual value realizations in the computer equipment industry, there is reason to question whether the front-end loading of income that is built into capital lease accounting is consistent with the second (degree of assurance) criterion for income recognition discussed in Section I. Our simulation results call attention to the potentially considerable error rates if unforeseen technological changes or other market shifts inhibit realization of forecasted residual values. While this type of uncertainty unavoidably permeates financial accounting, the key question is whether the magnitude of error in leasing situations is sufficient to require lessors to utilize a more "conservative" income recognition method.

To assess whether the potential for error imbedded in the capital lease front-end income loading is within tolerable bounds, we believe that statement readers would benefit from knowing the lessor's track record on residual value realizations. This could be accomplished by providing a schedule that compares the book value of the assets at time of sale (i.e., the original estimated residual value) with the actual proceeds realized upon sale. Lessors who have demonstrated a history for choosing attainable residual values would presumably be more likely to be measuring current income using similarly attainable residual values. A schedule of gains and/or losses on ultimate disposition of these leased assets would facilitate investors' assessments of the quality of lessors' current earnings and would allow assessments regarding the "conservatism" of residual value estimates and appropriateness of capital lease accounting.[32]

Focusing on equity sales in isolation, our analysis in Section II also indicates that there is little justification in treating as income upon receipt that portion of proceeds from equity interest sales which represent "carve-outs" of future flows. Instead, such inflows should be deducted from the lessor's asset carrying value. To do otherwise simply increases the magnitude of any subsequent reversal insofar as the (non-offset) residual value is not attained.

While the accounting issues are clear, the existing financial statement disclosures for equity sales are sparse. Comdisco's 1982 disclosures (i.e., pre-*Barron's*) are an example, since little indication is given regarding the accounting for sales of equity interests. This is especially noteworthy in light of the size of these items in relation to total revenues. Even after the precipitous price decline that followed the *Barron's* article, Comdisco's 1983 annual report disclosure on this issue is ambiguous. While it appears that Comdisco did change its accounting for sales of equity interests between October 12, 1983 (the date of Comdisco's President's letter to shareholders—see fn. 17) and November 9, 1983 (the date of the auditor's opinion), the exact nature of the change is unclear. Since there was no disclosure of a change in an accounting principle or its dollar impact, we suspect that Comdisco's change in accounting for sales of equity interests was applied on a prospective basis. Furthermore, were it not for supplementary information provided to us, it would be unclear whether the new accounting treatment meant that the *full* present value of the initial residual value was deducted from proceeds. Indeed, this ambiguity continues in the Comdisco 1986 annual report which states:

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[32] In its 1986 annual report, Comdisco initiated voluntary disclosure of remarketing (i.e., re-leasing) revenues and book values related to re-leased assets. Comdisco's 1988 annual report (which became available only as this article was going to press) clarified and expanded the original (1986) disclosure format. Comdisco provides a five-year schedule that compares net book value at lease termination with the discounted present value of the contractual re-lease payments due. This is an extremely valuable disclosure extension which we believe ought to be included in all lessors' financial statements. However, Comdisco's disclosure excludes outright sales of equipment. To allow a complete analysis of the adequacy of residual values, all assets whose leases terminated should be incorporated including those that could not be re-leased and/or were sold for cash.

> Payments and notes received are first applied to reduce the residual value of the equipment at the expiration of the initial lease....The excess of the proceeds over the reduction of residual value is recorded as lease revenue in the period in which the equity transaction occurs [p. 25].

Notice the ambiguity regarding the *amount* that is "first applied to reduce the residual value." Is it the full year zero present value or some lesser amount? Since the revenue from equity transactions was $46.7 million in 1986 and earnings before extraordinary gain were $79 million, the impact of crediting less than the full residual against the asset account could be significant. In this particular instance, Comdisco personnel did provide us with a document that explains that if Comdisco sells 100 percent of the residual value, it does in fact credit the time-zero present value against the asset account.[33] However, since this information is not currently in the annual report, our concern remains that existing GAAP disclosure in this area is inadequate for informed analysis.

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[33] Comdisco, Inc., *Explanation of Accounting for Leases* [1986]. Similarly, when Comdisco sells only 50 percent of the residual value, then 50 percent of the t_0 present value is offset against the asset account.

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BOOK REVIEWS

Richard P. Brief, Editor

Editor's Note: Beginning June 1, 1989, books for review should be sent to Professor Shane R. Moriarity, School of Accounting, University of Oklahoma, Norman, OK 73019.

J. E. BORITZ, B. G. GABER, and W. M. LEMON, *An Experimental Study of Review of Preliminary Audit Strategy by External Auditors*, Studies in Canadian Accounting Research (Toronto: The Canadian Academic Accounting Association, 1987, pp. x, 149, Can. $25.00 paper).

This monograph reports the results of a comprehensive research project examining the audit planning judgments of 80 auditors at four different staff levels from ten large public accounting firms in Canada. The stated objectives of the study [p. 1] are rather broadly identified as providing descriptive data on audit strategy formulation and testing hypotheses of behavior in an experimental manner. The abstract notes that "This study can be viewed as a description of the state-of-the-art in audit planning in the profession today."

The book is logically organized into five chapters: Introduction; Research Methodology; Audit Strategy; Discussion of the Judgments Selected ...and Findings; and Summary of Significant Findings and Their Implications. Auditors were provided background information about a new client and asked to review the tentative audit strategy prepared by a subordinate staff member. This plan comprised ten audit judgments intended to reflect the full planning phase, including assessments of overall audit risk, inherent and control risks, materiality, and planned reliance on controls and substantive procedures. The preliminary plan (the anchor) was manipulated at two levels: moderate and low overall audit risk. Auditors were asked to make three sets of decisions: an evaluation of the plan, revision of the plan, and an assessment of the difficulty of each judgment. Further, auditors were required to make these decisions for four client scenarios representing dichotomous manipulations of five cues: prior audit problems; financial health; state of the inventory; internal controls; and type of engagement (private vs. prospectus client). Finally, subjects responded to two cases silently and for the other two cases were asked to think aloud. In all, the study is a one-half fractional 2^7 factorial ANOVA, reflecting a very complex research design covering numerous variables.

Many of the findings are quite interesting and suggestive of future avenues for research or focus in practice. A few of the most significant results are noted here. Strong anchoring effects on the tentative audit plan were found, suggesting the review process leads to some revision of initial work but may not fully compensate for extreme errors. Significant firm effects also were reported; surprisingly, the more quantitative firms did not display greater intra-firm consensus. Finally, the planned overall audit risk achieved, based on assessed control/inherent risks and reliance on substantive tests, did not appear to conform to either the Canadian or American risk models espoused by the professional standards of each country.

As noted, the research study is very comprehensive, attempting to tie together numerous judgments in the planning process. The authors are to be commended for tackling this difficult task and for the careful design and execution of the study. The objectives, design, and findings are also discussed clearly and in detail, although reading of the details may be tough going and proceed slowly for those who are not academic researchers. However, Chapters 1 and 5 provide concise summaries of the design and key findings for those who do not wish to delve into the details. A strong feature of the monograph is that it contains an excellent review of the literature on audit planning, providing one with a good overview of the state-of-the-art in this area. For example, Chapter 2 contains an excellent discussion of risk assessment and the risk models.

In considering the findings, however, a few limitations of the study should be borne in mind. First, the research examines *review judgments* given a preliminary plan. There is not a control group where no plan is provided. Thus, we do not know what the planning judgments may have been without this initial anchor. Hence, one must be cautious in concluding the judgments made are indicative of those that would be made in practice. Further, the initial plan could have suggested appropriate ranges or relationships between these very difficult judgments and, thus, bias responses. For example, in the plan the precision was set at 50 percent of materiality, and the results mirrored this. I believe the findings regarding anchoring effects should have been presented *first* and then results on individual judgments discussed next bearing this in mind. Secondly, as the monograph notes, auditors are frequently not accustomed to making the quantitative judgments examined in the study or in using many of the response scales employed. Therefore, did auditors not conform to the risk models, as suggested, or were subjects not used to making and aggregating such quantitative judgments?

Some of the conclusions in Chapter 5 seem too broad or not fully supported, e.g., that auditors do not conform to the risk models. The results actually indicate the planned overall risk fell safely between the AICPA and EAT recommended values; further, auditors displayed strong consensus in the high risk scenario. There were no hypotheses presented in the true sense, nor were there normative benchmarks to indicate which anchor was in error or which auditors did "better." Lastly, the justification for the choice, manipulations, and/or expectations regarding some of the variables was not clear, e.g., prior audit problems: immaterial prior errors or immaterial employee inventory theft.

Despite the shortcomings noted, this monograph is a valuable addition to the literature and provides some potentially important findings for practice and future research. The volume is well worth reading for researchers interested in this area, practitioners with a research orientation, and those wishing to obtain a broad background on audit planning.

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LOUIS GOLDBERG, *Dynamics of an Entity: The History of the Accounting Association of Australia and New Zealand* (St. Lucia, Australia: Accounting Association of Australia and New Zealand, 1988, pp. 301, Aust. $19.00 paper).

This study of the Australian/New Zealand counterpart to the American Accounting Association was produced by a leading figure in Australia's first generation of full-time academic accountants. In 1958, four years after Goldberg had joined with his distinguished fellow countrymen, Raymond Chambers and Russell Mathews, in serious discussion of such a group, the Australian Association of University Teachers of Accounting was formed. These men were members of a small committee that forged a constitutional base for the new organization before serving from 1960–1963 as its first three presidents.

Following coverage of the association's very first years, Goldberg devotes Chapters 6–12 to detailed chronology of constitutional development; membership; a literary organ; annual conferences; finances; interaction with other organizations (primarily); and additional contributions to accounting education and research. For the scarcely two dozen years covered, this simple structure works reasonably well.

Organizational growth, 1960–1984, from 29 Australian university accounting instructors to 531 individuals from a broadened geographic, institutional, disciplinary, and occupational base relates to two name changes. "Australasian" replaced "Australian" when New Zealanders were admitted in 1964, while the entry of teachers from "technical colleges" and other schools of "tertiary" education below university grade and, on a much smaller scale, nonacademic members invited the current name. Admission to the "AAANZ" of professors from "cognate" fields did not comprise its basic identity.

The association introduced a periodical in 1961. For some years it was a newsletter, issued somewhat irregularly amidst low submission levels, serving a widely dispersed membership as a communication vehicle. The succession in the 1970s from the *News Bulletin* to *Accounting Education* marked a movement toward research distinction that would culminate in today's journal, *Accounting and Finance*. In addition, the first special interest group formed within the AAANZ has since 1980 published an *Accounting History Newsletter*.

A style virtually untouched by anecdote yields a "read" through Chapter 8 that, although reliably informative, is rather laborious. The tone lightens with the coverage in Chapters 9 and 10 of conventions, long the primary research endeavor, and financial development. Convention lore includes the earnestness of a '"younger"' Australian member in following up by mail and telephone alike on a request for double-bed accommodations in 1969; and the "near loss" in 1976 of keynote speaker Eldon Hendriksen, who when found was about to embark unwittingly on a day-long boat tour rather than ferry to the meeting site.

Through partially subsidized conventions and steady dues increases not retarding growth, the association's financial position improved handsomely in later years covered. The cash-based accounting has been surprisingly informal, however, and at times inept. Only arm twisting by the executive committee averted an unfavorable audit report in 1972, whereupon its spokesman made several calculational errors to divert member attention from questionable items. Ten years later a chief auditor selected from within AAANZ ranks expressed serious concern about the organization's accountability.

Without notable success, the association has tried over the years to form working relationships with the bodies that control entry into professional accountantship in their country, the Australian Society of Accountants and the Institute of Chartered Accountants in Australia. Goldberg assumes more familiarity with those groups and their requirements, especially the "professional year," than a foreign reader is likely to have. The AAANZ seems to have had scant policy influence even as higher education has emerged as the basic source of entry-level knowledge for Australian accountants.

Goldberg, a distinguished theorist, concludes his text by assessing the association's development in terms of selected concepts of accounting "entity." He finds that it has indeed functioned, meaningfully, as a discernible entity. Although the conceptual survey may be useful in its own right, the reviewer is not convinced that the author's applications supply much more than intellectual wrapping for commonsensical conclusions.

Goldberg supplemented excellent association archives with personal files including special correspondence with other former presidents, and presents or generously excerpts numerous source documents. His coverage and interpretation seem admirably unbiased. Although written mainly for an audience from "down under," the book is commended to accounting professors from comparable groups around the world, especially the more active or historically-minded participants.

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Editor's Note: This book is available from AAANZ, c/o Department of Commerce, University of Queensland, St. Lucia, Queensland 4067, Australia. Equivalent payment in U.S. dollars is acceptable.

C. J. McNAIR, WILLIAM MOSCONI, and THOMAS NORRIS, *Meeting the Technology Challenge: Cost Accounting in a JIT Environment* (Montvale, NJ: National Association of Accountants, 1988, pp. xx, 280, $33.95 paper).

In response to changes in the current business environment, the National Association of Accountants (NAA) has initiated a series of studies to identify the usage of management accounting techniques and to show how these techniques can be adapted to changing technologies. The purpose of this study, which was jointly sponsored by NAA and Coopers & Lybrand, was to explore the impact of just-in-time (JIT) manufacturing on performance measurement and project evaluation. The researchers used a case cluster approach based on the naturalistic inquiry paradigm. The appendix presents a brief discussion of the methodology and a copy of the questionnaire used during the site visits.

The monograph is divided into three parts. Part I (Chapters 1-3) describes the changing environment faced by manufacturers. Chapter 1 briefly addresses the current environment and management accounting practices. Chapter 2 describes the new manufacturing environment in terms of the technologies available for production. JIT manufacturing is described "...as a philosophy of management that is dedicated to the elimination of waste" [p. 16]. Chapter 3 discusses cost management in an advanced manufacturing technology (AMT) environment. Most of the material in Part I is a summary of the literature dealing with advanced manufacturing technologies and cost management.

The five case studies are presented in Part II (Chapters 4-8). Each chapter describes the researchers' findings at a specific company. Four of the cases deal with companies in the electronics industry while the fifth case deals with a basic machine shop operation. Each chapter identifies the manufacturing technologies used at the research site and changes in the management accounting system (MAS) that have occurred because of changes in technology. The five companies varied widely in their use of the various AMTs and in the changes in their MASs.

Part III (Chapters 9–12) summarizes the principal findings of the research and discusses MAS in a JIT environment. The research propositions and hypotheses are analyzed in Chapter 9. The principal findings are:

> ...reactive [rather than proactive] decision making, based on competitive pressures, underlies most technology adoptions,...basic control and support systems are not being mastered prior to technology adoption..., and...accounting changes are, for the most part, lagging technology adoptions [p. 177].
>
> One consistent MAS modification noted at each site is the replacement of the traditional standard cost system with one based on actuals and/or rolling averages of actuals [pp. 177–178].

Chapter 10 presents observations and implications of accounting performance and JIT including a summary of current MAS changes and directions for future MAS. A framework for designing a MAS is presented in Chapter 11. Basic premises underlying the design are: (1) "Organizational activities are the most appropriate basic unit of analyses..." [p. 196], and (2) Economic events cannot be managed—only activities can be managed" [pp. 196–197]. The researchers recommend a data base approach to designing an activity-based MAS.

Chapter 12 summarizes the analyses in the book, suggests a path for the future of MAS design, and presents an example of a JIT-based accounting system. Primary differences between a JIT accounting model and the traditional model are: "(1) JIT costing approximates process accounting, (2) actuals replace standards as the primary basis for applying costs, and (3) volume-based costs are replaced by an increased focus on traceability" [p. 243].

By describing accounting practices and problems when new manufacturing technologies are used, the book adds to the growing volume of cost management literature. Although the title identifies the book as *Cost Accounting in a JIT Environment*, the book is not limited to JIT. Other technologies including manufacturing resource planning (MRP II), islands of automation (IA), and computer integrated manufacturing (CIM) are also discussed, and the performance measures identified in Chapter 12 include all of these technologies.

The book should be useful to managers and accountants who are trying to make management accounting systems more relevant when new manufacturing technologies are adopted. Unfortunately, the researchers do not give specific examples of how a MAS might be designed to provide all the information needed for cost management except to state that a data base system might be used. However, the listings of performance measures and cost drivers should be useful in identifying which activities to include in the data base.

Academic management accountants should also find the study of interest because it provides examples illustrating changes in management accounting systems. These examples should provide good background material for classroom discussions of how MASs may need to be changed in new environments. However, academics who expect rigorous statistical tests of hypotheses will be disappointed. Although hypotheses are developed and conclusions about whether the hypotheses are supported by the case studies are stated, there are no formal statistical tests. However, this strategy seems appropriate because of the case study methodology used. Additional research using other methodologies is needed to determine if the researchers' conclusions are valid for other companies and technologies.

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PANEL ON NONSTANDARD MIXTURES OF DISTRIBUTIONS, NATIONAL RESEARCH COUNCIL, *Statistical Models and Analysis in Auditing* (Washington, D.C.: National Academic Press, 1988, pp. xi, 91, $10.00 paper).

This monograph provides a highly interesting review and critique of the various statistical methods that have been developed over the last 15 years for specialized use in auditing. It is the end product of a panel commissioned in 1980 by the Committee on Applied and Theoretical Statistics which serves, in turn, the National Research Council's Board on Mathematical Sciences. In this report, the well-known statisticians of the panel call for additional statistical-oriented auditing research. They view this as an important problem of national interest for both the private sector (e.g., corporate auditing) and the governmental sector (e.g., tax auditing) of our society. They suggest that this new research could be fostered by a closer interaction between academic and practice-oriented accountants, auditors, and statisticians through a series of workshops, conferences, and courses.

The report is divided into four chapters: an introduction, a discussion of statistical auditing problems and the existing literature, a final summary with recommendations, and an annotated bibliography with both alphabetical- and chronological-oriented sections. The introduction and final summary are quite general in scope. These sections can provide a wide variety of readers a better understanding of some of the current statistical auditing issues. The annotated bibliography is also very informative and nontechnical, though by virtue of the task, it is primarily of interest to those with a research interest in statistical auditing.

The second chapter of the report provides a discussion of the special circumstances that arise in statistical auditing and the methodological proposals that have been made to cope with these circumstances. It has been long recognized that the distribution of errors in accounting populations are a mixture of no-error and in-error items with a further distribution on the magnitude of the error for those items that are in error. As discussed by the panel, these are "nonstandard" mixed distributions. That is, classical approaches to statistical inference are inappropriate and very little alternative theory has been developed. In particular, auditors cannot rely upon a wide variety of approaches based upon the normal distribution (e.g., difference estimation, ratio estimation, etc.). In many cases, these approaches will not provide them with an appropriate sense of confidence in an upper bound on the amount of error in an accounting population.

The first four sections of the second chapter of the report discuss these issues and the related research. The nature of the problem is documented using a variety of tables and figures based upon prior research. The remaining sections of the chapter focus on the various approaches that have been proposed for dealing with these problems. Nested within a quite technical and notational-oriented discussion are a number of interesting insights and a useful taxonomy for viewing this research. However, the details of this technical discussion will be mainly of interest to those with a strong research interest in the area.

As noted in the preface, the panel was particularly concerned that the report would reflect an appropriate knowledge of auditing issues. To this end, Professor Tamura of the University of Washington (who has been in recent years a major contributor to the statistical auditing literature), was appointed to the panel in 1985. He subsequently assumed overall responsibility for the report as well as for preparing the annotated bibliography. With one exception, the report reads like it was written by persons with an appropriate background in auditing. This is commendable.

The report is a rather ambitious undertaking given the rather extensive statistical auditing literature that has emerged over the last decade. In addition to providing a tutorial on these developments, the report is also a handy reference for seasoned researchers in the area. However, this type of reader must recognize that their individual appraisal of specific articles, and rankings and judgments of the significant developments in the statistical auditing, may not always coincide with that of the report.

RICHARD A. GRIMLUND
Associate Professor of Accounting
University of Iowa

SHIGEKI SAKAKIBARA, HIDETOSHI YAMAJI, HISAKATSU SAKURAI, KENGO SHIROSHITA, and SHIMON FUKADA, *The Japanese Stock Market: Pricing Systems and Accounting Information* (New York; Westport, CT; and London: Praeger Publishers, 1988, pp. xiii, 153, $42.95).

This book is a primer on major research findings about the Japanese stock market. It is worthwhile reading for any finance/accounting researcher who is familiar with research on the American data but not on the Japanese data, and who wants to embark on research on the latter. For such an individual, the text is easy to read and extremely informative, and it brings the reader up to date on the major empirical evidence for the world's largest stock market.

The book is divided into seven chapters. Six discuss major research findings, and the seventh summarizes. The six areas are:

1. The statistical behavior of aggregate and individual firm monthly returns.
2. Testing the CAPM.
3. Price performance of unseasoned new issues.
4. Market efficiency and the information content of annual accounting announcements.
5. The relationship between unexpected earnings and stock returns.
6. The usefulness to investors of the Japanese accounting disclosure system.

In each area, the authors replicate, with Japanese data, the major studies on these topics that were originally done with American data.

The primary results are:

1. Over the full postwar period, the distribution of returns does not appear to be normal, but normality is not so badly violated within shorter periods. The market model appears to suit the data reasonably well, but less so in more recent years, judging by such measures as goodness of fit.
2. The two-parameter Capital Asset Pricing Model does not seem to be an accurate characterization of returns; i.e., there was no (statistically significant) compensation for beta-risk over the full postwar period. There was some variation across five-year subperiods, with some showing support for the theory.
3. Unseasoned new issues behave similarly in both Japan and the U.S.; i.e., there are significant excess returns immediately after issuance, but only normal returns are earned in the aftermarket. This is the well-known "underpricing effect."
4. The Japanese stock market is extremely efficient in responding to unconsolidated annual accounting earnings, but not very efficient when it comes to consolidated earnings. That is, in the former, the familiar Ball and Brown pattern of CARs moving in the direction of the income change in the period before the announcement (15 trading days here) with the biggest price changes coming on the announcement day, and negligible drift thereafter, is found. For the latter, there is considerable drift over the 15 trading days subsequent to the announcement, implying a profitable trading opportunity. Additionally, there is a significant positive relationship between the magnitude of the earnings change and CAR over the announcement period, and significant trading volume increases occur only on the day of, and immediately following, the unconsolidated earnings announcement. These findings indicate that annual accounting information conveys useful information to the stock market. The authors speculate that the newness of consolidated information (only six years of history at the time of the study), and the market's consequent unfamiliarity with it, causes the delayed reaction.
5. Also similar to the well-known Ball and Brown results, good (bad) news portfolios, as measured by the sign and magnitude of the earnings forecast error, show security price movements consistent with their unexpected earnings over the year prior to the earnings release, implying that the market efficiently uses alternative information sources as well.
6. Judging by the behavior of residual security returns around the semiannual reporting periods, the Japanese accounting disclosure system is generally useful to investors, as one among many information sources.

While the book is interesting and informative as far as it goes, I found it wanting in two important respects. First, the studies tend to copy the methods of their American predecessors as if the Tokyo Stock Exchange were identical to the NYSE and AMEX. While there is some background information provided about disclosure policy and stock trading in Japan, I didn't feel that I came away from the book with a reasonable understanding of how the securities system works in Japan. It is not at all obvious to me that the American and Japanese systems are enough alike to copy research methods. For example, there is no justification given for assuming a martingale model for annual earnings, and the uniformly lower R^2s from market model regressions (when compared with U.S. data) implies the question, for example, of whether an industry effects model might be desirable. More discussion of the similarities and differences between the American and Japanese stock exchanges is necessary for me to assess the applicability of the methods used.

Second, in almost all cases, the authors addressed research issues and used methodologies that are not very new. Yet, the 1980s have seen important and exciting new findings in U.S. stock price data. Some of the more well-known examples are the size and January phenomena, and the issue of excess volatility of stock prices. These findings have made many people question the veracity of the standard CAPM and/or the market efficiency paradigm. Yet, no discussion is given to any of these issues. The book leaves one wondering whether the Japanese stock market is characterized by these empirical regularities as well. I await the authors' next edition to answer these questions.

PAUL ZAROWIN
Assistant Professor of Accounting
New York University

NEW BOOKS: AN ANNOTATED LISTING

Editor's Note: As a general policy, books received but not reviewed in this or future issues will be annotated. There will be some exceptions.

EDWARD I. ALTMAN, *The Prediction of Corporate Bankruptcy: A Discriminant Analysis*, Foundations of Accounting Series (New York and London: Garland Publishing, Inc., 1988, pp. 149, $30.00).

Ph.D. thesis, University of California, Los Angeles, 1967. Thesis limits its discussion to manufacturing firms and defines a failed firm as one which has filed formal petition of bankruptcy with the courts, or has had such a petition filed against it. Purpose is to develop a bankruptcy predictive model, using multiple discriminant analysis based on financial and economic ratios. Part one of the study discusses use and advantages of various financial ratios in evaluating credit worthiness and risk, and describes multiple discriminant analysis (MDA) as a statistical research technique; part two develops the discriminant model and tests the model's reliability; final section analyzes the implications of results and explores applications of the model. Author argues that the model's simplicity and low cost make it easy to apply and its use is recommended for credit evaluation, internal and external management considerations, and investment guidelines. Six appendices document results on sampling of 66 firms.

Edward I. Altman is currently Max Heine Professor of Finance at the Stern School of Business, New York University.

AMERICAN INSTITUTE OF ACCOUNTANTS, *Accountants' Index 1920: A Bibliography of Accounting Literature*, Foundations of Accounting Series (New York and London: Garland Publishing, Inc., 1988, pp. 1578, 2 volumes, $200.00).

First published in 1919, revised and reprinted in 1921. Bibliography provides a comprehensive guide to reference books and general literature, published during the late 19th and early 20th centuries, concerning accounting and allied subjects. Publications are listed alphabetically by subject, author, and title arranged in a single alphabet listing. Thus, each reference may be searched for on the basis of title, subject, or author; also provided is information about the publisher, place and date of publication, and number of pages. Two volumes provide reference to all major articles and books published during the early years of the development of accounting profession in the United States.

The American Institute of Accountants was formed in 1916, as a restructuring of the American Association of Public Accountants established in 1887. In 1957, the American Institute of Accountants was renamed The American Institute of Certified Public Accountants.

ROBERT E. BENNETT, JAMES A. HENDRICKS, DAVID E. KEYS, and EDWARD J. RUDNICKI, *Cost Accounting for Factory Automation* (Montvale, NJ: National Association of Accountants, 1987, pp. xi, 70, $11.95 paper).

Study based on information collected from interviews with personnel in the engineering, manufacturing, and accounting departments of seven companies. Examines cost accounting problems in today's automated factory environment that result from the acquisition of numerical control machines, computer aided design/computer aided manufacturing machines, flexible manufacturing systems, and material handling systems. Addresses problems specific to each of these automated systems and problems common to all four, including: justification of acquisition through clearly quantified benefits; cost control difficulties arising from the replacement of direct labor costs by depreciation and machine costs; determination of appropriate overhead application base for product costing; and quantification of benefits from automated processes. Authors provide short-term recommendations for individual manufacturers and longer-term recommendations for the accounting field.

Robert E. Bennett is Associate Professor of Accountancy at Northern Illinois University; James A. Hendricks and David E. Keys are Professors of Accountancy at Northern Illinois University; and Edward J. Rudnicki is a retired partner at Coopers & Lybrand and a Graduate Student at Northern Illinois University.

JOHN BATES CLARK, *Capital and Its Earnings*, Foundations of Accounting Series (New York and London: Garland Publishing, Inc., 1988, pp. 80, $25.00).

New introduction by Donald Dewey. First published in 1888, and one of American Economic Association's earliest publications. Study laid foundation for the modern treatment of capital and interest. In the treatise Clark refutes the then commonly held views that capital consists of durables and a stock of produce used by workers during the "period of production" and that interest is payment to the savers that make "this wages fund" possible by abstinence. The more widely recognized works of Irving Fisher were built on Clark's formulation of definitions presented here: capital as a permanent fund of productive power and income as its permanent flow of services.

John Bates Clark graduated Amherst class of 1872, studied in Germany with Karl Knies, and accepted his first professorship at Carleton College, Minnesota. Donald Dewey is Professor of Economics at Columbia University.

EDWARD B. DEAKIN, MICHAEL W. MAHER, and JAMES J. CAPPEL, *Contemporary Literature in Cost Accounting: A Bibliography with Selected Annotations* (Homewood, IL: Richard D. Irwin, Inc., 1988, pp. v, 123, $18.95 paper).

Bibliography provides instructors, accountants, and managers with a guide to recent literature published in connection with new developments in cost accounting. Part I presents 36 annotated articles providing a cross-section of current writings. Articles summarize major factors that have given rise to the revolutionary changes in cost accounting. Part II provides a comprehensive bibliography on cost accounting published since 1984. Last section is an alphabetical listing of contemporary literature on cost accounting.

Edward B. Deakin is Institute Chair Professor and Director, Institute of Petroleum Accounting, University of North Texas. Michael W. Maher is Professor of Accounting at University of California, Davis. James J. Cappel is at the University of North Texas.

JAMES DON EDWARDS, *History of Public Accounting in the United States*, Foundations of Accounting Series (New York and London: Garland Publishing, Inc., 1988, pp. 368, $35.00).

Hardback edition in the Classics Series of the Academy of Accounting Historians. A contemporary history of public accounting in the United States, first published in 1960. After three introductory chapters, book is organized along chronological lines. Five major historical eras are analyzed. "The Emergence of Public Accounting in the United States, 1748-1895" spans the period from earliest known accounting activities in the colonies through the establishment of the first firms. "Public Accounting in the United States, 1896-1913" discusses the increased diversity of the practitioners' responsibilities, and the business community's increased need for the accounting practitioner, and covers the history of C.P.A. legislation and the C.P.A. examination. "Public Accounting in the United States, 1913-1928" deals with the establishment of the American Institute of Accountants and the American Society of Certified Public Accountants, the growth of the profession under the income tax law of 1913 and the enactment of C.P.A. legislation by all states and territories. "Public Accounting in the United States, 1928-1949" discusses influences of the depression, the establishment of reporting standards of certified statements, the effect of the Securities Act of 1933, and the friction between the legal profession and certified public accountants. "Public Accounting in the United States During the 1950's" chronicles the development of the code of ethics.

James Don Edwards was Professor and Head, Department of Accounting and Financial Administration, Michigan State University at the time of original publication. He is now J. M. Tull Professor of Accounting, University of Georgia.

JAMES DON EDWARDS and ROLAND F. SALMONSON, *Contributions of Four Accounting Pioneers: Kohler, Littleton, May, Paton*, Foundations of Accounting Series

(New York and London: Garland Publishing, Inc., 1988, p. 238, $24.00).

Reprinted for the first time in the Classics Series of the Academy of Accounting Historians. A digest of articles written by four twentieth century accounting authorities: Eric L. Kohler; A. C. Littleton; George O. May; William A. Paton. Each of book's four chapters is devoted to one author and provides a brief biographical sketch followed by a chronological listing of major literary contributions. A synopsis of the major points and arguments of each publication enables readers to assess their interest in reading the full article. Articles and their topics are germane to the development of accounting from the early twentieth century to the late 1950s, and collectively provide a brief history of accounting thought during the first half of the twentieth century. Comprehensive index allows cross referencing.

Roland F. Salmonson retired from Michigan State University in 1982. James Don Edwards is J. M. Tull Professor of Accounting, University of Georgia.

JOHN P. FERTAKIS, *The Corporate Director's Financial Handbook* (New York; Westport, CT; and London: Quorum Books, 1988, pp. xii, 186, $39.95).

Book is intended to provide corporate board members with the practical information needed to interpret financial and operating statements; directed to new board members and nonfinancial specialists. Thirteen chapters address the director's role and responsibilities as they relate to different sectors of the organization including the board of directors, stockholders, management, and the corporate treasurer and controller. Provides guidelines for analysis of the corporation's activities through interpretation of its financial statements and reports. Handbook's topics include an examination of the four primary financial statements issued by corporations, the relationship between financial statements items and their meaning for specific areas, identification of important areas for evaluation of organization performance, basic aspects of managerial and cost accounting, and utilization of an audit report to recognize underlying corporate inefficiencies. Twenty-two figures throughout the book supplement the text discussions, and the appendix replicates a standard corporate annual report.

John P. Fertakis is Professor of Accounting and Business Law at Washington State University.

S. PAUL GARNER, *Evolution of Cost Accounting to 1925*, Foundations of Accounting Series (New York and London: Garland Publishing, Inc., 1988, pp. xiv, 416, $43.00).

Hardback edition in the Classics Series of the Academy of Accounting Historians. Focuses on accounting practices associated with the cost of production: raw material, direct labor, manufacturing burden, integration of factory and financial accounts, interdepartmental transfers of products, by-products costing, waste material management, job order and process cost systems, and valuing factory inventories. Emphasis is on evolution of cost accounting through World War I. Study confines its locale to England and the United States since these countries provided models for most other nations. First two chapters trace the history of developments in cost accounting development from fifteenth century through nineteenth century England. Author then examines the origin, evolution, and development of cost accounting concepts.

Professor S. Paul Garner retired as Dean, School of Commerce and Business Administration, University of Alabama, in 1971.

JOHN Y. LEE, *Managerial Accounting Changes for the 1990s* (Reading, MA: Addison-Wesley Publishing Company, 1987, pp. 87, $6.95 paper).

Study is concerned with the effects on managerial accounting of the U.S. industry's rapidly changing technologies. Within the framework of U.S. industry's present environment, including increased foreign competition and managerial influences, study examines the need for adoption of new production, quality control, and inventory management techniques. Explores the origins of industry weaknesses and the need for adoption of new techniques to remain competitive through the next decade. Looks at some corporations which have responded to market challenges by successfully implementing some of these techniques including, among others, Just in Time Inventory (JIT) and Optimized Production Technology. Examines evolving technology of the manufacturing industry. Describes the ideal state of computer integrated manufacturing and how it compares to the present state of computerization in the field. Discusses how the industry's manufacturing objectives will change as factories approach full automation and manufacturing is directed more toward specific customer, one of a kind, smaller batch production.

Book's discussions of the effects of changing environment fall into three main subgroups: those classified as affecting product costing systems and control; developments that influence performance measurement and management control systems; and developments classified as special topics. A final summary lists topics discussed in the book and provides an overview of future developments in managerial accounting relating to: job order costing, process costing, changing cost structure, JIT and cost system modification, JIT and inventory valuation, variable costing vs. absorption costing, cost collection in the new environment, knowledge workers and learning curves, cost allocation, the service industry, new types of costs, cost control, changing role of the management accountant, automation and efficiency, positive performance, measurement of positive performance, human resource accounting, and the impact on capital budgeting.

John Y. Lee is at California State University in Los Angeles.

A. C. Littleton, *Accounting Evolution to 1900*, Foundations of Accounting Series (New York and London: Garland Publishing, Inc., 1988, pp. 373, $37.00).

Hardback edition in the Classics Series of the Academy of Accounting Historians. First part, traces the evolution of double entry bookkeeping through its fifteenth century academic origins, illustrious proponents, and development as a response to societal needs. Emergence of double entry bookkeeping is viewed through the keeping of "economic accounts," as a service to the proprietor. Development of discipline is chronicled from simple account keeping to a detailed system of proprietorship bookkeeping. Interprets early theory through analysis of ledger entries, other written records, and the fifteenth century text of Paciolo. Compares these early methods of bookkeeping to modern methods. Reviews changes in the form and wording of ledger entries, and the effect of the development of journal entries on the complexity of the discipline. Follows the development of financial statements.

Part II deals with the expansion of bookkeeping into accountancy and focuses on the nineteenth century and the adaptations in bookkeeping to meet needs of post Industrial Revolution environment. Progressive changes during the nineteenth and twentieth centuries expanded bookkeeping into accountancy enabling it to keep pace with current problems. Issues covered include the influence of the corporation; the railroad industry's impact on recognition of depreciation; limited liability; development of the practice of auditing and its background in Britain; the origins of cost accounting; and cost developments in the late nineteenth century. First published in 1933 reissued in 1966.

A. C. Littleton was Professor of Accounting at the University of Illinois.

Robert T. March, *The Investment Side of Corporate Cash Management* (New York; Westport, CT; and London: Quorum Books, 1988, pp. viii, 225, $39.95).

Purpose is to provide finance professionals with guidelines to structure corporate investment portfolios, particularly in view of the effects of the Tax Reform Act of 1986, and recent major stock market upheavals. Chapters 1 and 2, "Essential Guidelines for Establishing an Investment Policy" and "Investment Analysis," provide guidelines for development of a corporate investment policy to insure the investor's decisions mirror the management's objective. Chapter 2 also undertakes an analysis of different types of risk. Chapter 3, "Investment Instruments," reviews in detail traditional short-term money market instruments and new, rapidly expanding investment vehicles. Instruments are reviewed in detail according to risk, liquidity, marketability, yield, and minimum amounts of money and time needed to enter each market. Provides guidelines for developing a corporate investment strategy that allows temporary surplus funds to be invested safely and profitably. Chapter 4, "Guidelines to Automating the Treasury Management Function," discusses automated treasury management and Chapter 5, "Investing Software," assesses the benefits and disadvantages of different types of data bases and investment software. The final chapter, "Impact of Tax Reform on Corporate Treasury Management," looks closely at the effects of the tax reform on corporate investment and investment strategies. Book is intended for use by practitioners who have varying levels of experience.

Robert T. March heads two investment cash management firms and has over twenty years of business and financial experience in the field.

H. J. METTENHEIMER, analyzed and restored by PETER L. MCMICKLE and PAUL H. JENSEN, *The Auditor's Guide of 1869* (New York and London: Garland Publishing, Inc., 1988, pp. 106, $30.00).

Introduction describes restorers' trail of discoveries that led to this publication—from the omission of any reference to H. J. Mettenheimer's *The Auditor's Guide of 1869, Being a Complete Exposition of Bookkeepers Frauds* in bibliographies identifying early American publications on auditing, to the discovery that the original and only existing copy of the manual had been discarded by the Library of Congress and retained only in a barely legible form on microfilm. After supporting the claim that this book, rather than George Soule's 1892 *Manual of Auditing*, is the first American book published on auditing, a comparison of the objectives of the writings of the two earlier works is given. The 1869 Guide, and its revised edition published in 1875 entitled *Safety Book-keeping*, are briefly described and analyzed. The remainder of the book presents a computer enhanced reproduction of the 1869 publication and the 1875 edition.

Peter McMickle is a Professor at Memphis State University, School of Accountancy. Paul Jensen is an Instructor at the University of Central Arkansas, Department of Accounting.

NETHERLANDS INSTITUTE OF ACCOUNTANTS and the ASSOCIATION OF UNIVERSITY TRAINED ACCOUNTANTS, *Proceedings of the Seventh International Congress of Accountants 1957*, Foundations of Accounting Series (New York and London: Garland Publishing, Inc., 1988, pp. 714, $150.00).

First published in 1957, book details proceedings of the Seventh International Congress of Accountants, September 9-13, 1957. Part One: provides an account of the sponsoring bodies, Congress committee and secretariat, ladies committee, other committees and subcommittees, chairmen of the business session, and the programme of the Congress. Part Two: contains papers presented at the Congress which pertain to six subjects. (1) Principles for the Accountant's Profession: papers by Sir Thomas B. Robson, Carman G. Blough, Oiar I. Cassell, A. Th. de Lange, and Heinrich Wollert. (2) Budgeting and the Corresponding Modernization of Accounting: papers by Herbert Ratsch, S. Prakash Chopra, Joseph Pelej, A. F. Tempelaar, and J. P. Wilson. (3) The Verification of the Existence of Assets: papers by J. A. de Lalanne, Donald J. Bevis, R. Burgert, Claude Paquet, Sir Richard Yeabsley. (4) Business Organization and the Public Accountant: papers by F. M. Richard, S. C. Bakkenist, J. E. Harris, Savante Kihlman, G. L. Phillippe. (5) The Internal Auditor: papers by W. A. Walker, R. A. Irish, L. G. Macpherson, Ernest Sinnott, W. N. A. F. H. Stokvis. (6) Ascertainment of Profit in Business: papers by G. L. Groeneveld, Ira N. Frisbee, Palle Hansen, C. I. R. Hutton, Leopold L. Illetschko, and Emile Mangal. Part Three contains Appendices which enumerate the bodies represented and alphabetical lists of participants from abroad; participating members of the sponsoring bodies; guests at delegates' dinner, menu and list of toasts; and photographs.

W. B. REYNOLDS and F. W. THORNTON, "Duties of a Junior Accountant," *Journal of Accountancy* (September-November 1917) bound with A. B. CIPRIANI, *Duties of a Junior Accountant*, revised and enlarged edition (New York: American Institute Publishing Co., Inc., 1933) bound with R. K. MAUTZ, "Duties of the Junior Accountant," from ROBERT L. KANE, JR., Editor, *Duties of Junior and Senior Accountants, Supplement of the CPA Handbook* (New York: American Institute of Accountants, 1953), Foundations of Accounting Series (New York and London: Garland Publishing, Inc., 1988, pp. 297, $45.00).

This one volume binds three publications which span over three decades of thought on the duties and responsibilities of "junior accountants." Thornton and Reynolds' work was originally published in a three-part serial format. Introductory remarks highlight differences between questions the potential CPA candidate addresses on the CPA examinations or encounters in professional journals, and tasks the candidate addresses on the job. Descriptions of duties are provided. Book also addresses less tangible responsibilities such as aspects of conduct in the clients' office, appearance and style of reports, and achievement of accuracy and clarity in work.

A. B. Cipriani's book was written in response to the need for a revision of Thornton and Reynolds' publication. The work differs to such an extent from the original, however, that it is considered a new treatise. Covers in more depth, a broader range of topics than its predecessor and provides a fairly comprehensive procedural manual.

R. K. Mautz' publication was originally intended for inclusion in the *CPA Handbook* and was published instead as an independent supplement. Eight chapters discuss the general scope of the junior accountant's duties, specific issues pertaining to auditing, and the fundamentals needed for the beginning accountant to progress in the profession. Twelve illustrative worksheets provide reference for the book's discussions.

F. W. THORNTON, *Duties of the Senior Accountant* (New York: American Institute of Accountants, 1932) bound with JOHN C. MARTIN, "Duties of the Senior Accountant," from ROBERT KANE, JR., Editor, *Duties of Junior and Senior Accountants, Supplement of the CPA Handbook* (New York: American Institute of Accountants, 1953), Foundations of Accounting Series (New York and London: Garland Publishing, Inc., 1988, pp. 204, $45.00).

Thornton's work of 18 essays was intended to supplement knowledge gained in the course of routine work and help prepare for the transition to senior. Book was also meant to serve as an easily portable guide for addressing important issues that arose in everyday work. Essay topics include: "Arranging Work and Staff," "Assembling Schedules," "Collaboration with Other Seniors," "Internal Check," "The Senior and the Client," and "The Position of Seniors in an Organization."

John Martin's update was originally scheduled for publication in the *CPA Handbook*, but was published instead as a separate supplement. Five chapters discuss duties of the senior accountant: "General Responsibilities," "Responsibility for Planning," "Conduct of an Audit," "Completing an Engagement," and "Additional Responsibilities." The Appendix reproduces the American Institute of Accountants' 1950 publication, "Audits by Certified Public Accountants...Their Nature and Significance" and relates "in general terms what the CPA does in order that he may express an opinion on financial statements."

Editor's Note: Heidi Cunnick assisted the editor in annotating these books.

BOOKS RECEIVED FROM SEPTEMBER 17, 1988 TO NOVEMBER 23, 1988

EDWARD I. ALTMAN, *The Prediction of Corporate Bankruptcy: A Discriminant Analysis*, Foundations of Accounting Series (New York and London: Garland Publishing, Inc., 1988, pp. 149, $30.00).

AMERICAN INSTITUTE OF ACCOUNTANTS, *Accountants' Index 1920: A Bibliography of Accounting Literature*, Foundations of Accounting Series (New York and London: Garland Publishing, Inc., 1988, pp. 1578, 2 volumes, $200.00).

JOSE ANTONIO GONZALO ANGULO and JORGE TUA PEREDA, *Introduccion a La Contabilidad Internacional* (Madrid: Ministerio de Economia y Hacienda, 1988, pp. 256, 550 pesetas paper).

AHMED BELKAOUI, *The New Environment in International Accounting* (New York; Westport, CT; and London: Quorum Books, 1988, pp. 220, $49.95).

ROBERT E. BENNETT, JAMES A. HENDRICKS, DAVID E. KEYS, and EDWARD J. RUDNICKI, *Cost Accounting for Factory Automation* (Montvale, NJ: National Association of Accountants, 1987, pp. xi, 70, $11.95 paper).

DIEGO DEL CASTILLO; PATTI MILLS, Translator, *The Legal Literature of Accounting*, Foundations of Accounting Series (New York and London: Garland Publishing, Inc., 1988, pp. 120, $30.00).

JOHN BATES CLARK, *Capital and Its Earnings*, Foundations of Accounting Series (New York and London: Garland Publishing, Inc., 1988, pp. 80, $25.00).

Edward B. Deakin, Michael W. Maher, and James J. Cappel, *Contemporary Literature in Cost Accounting: A Bibliography with Selected Annotations* (Homewood, IL: Richard D. Irwin, Inc., 1988, pp. v, 123, $18.95 paper).

James Don Edwards, *History of Public Accounting in the United States*, Foundations of Accounting Series (New York and London: Garland Publishing, Inc., 1988, pp. 368, $35.00).

James Don Edwards and Roland F. Salmonson, *Contributions of Four Accounting Pioneers: Kohler, Littleton, May, Paton*, Foundations of Accounting Series (New York and London: Garland Publishing, Inc., 1988, pp. 238, $24.00).

John P. Fertakis, *The Corporate Director's Financial Handbook* (New York; Westport, CT; and London: Quorum Books, 1988, pp. xii, 186, $39.95).

Financial Accounting Boards, "Deferral of the Effective Date of Recognition of Depreciation by Not-for-Profit Organizations" *Financial Accounting Series Statement of Financial Accounting Standards*, No. 93, September 1988 (Norwalk, CT: Financial Accounting Standards Board, 1988, pp. 5, $125.00 one year subscription-paper).

Financial Accounting Standards Board, *Original Pronouncements Volume I* (Homewood, IL: Richard D. Irwin, Inc., 1988, pp. iii, 506, $19.25 paper).

Financial Accounting Standards Board, *Current Text: General Standards* (Homewood, IL: Richard D. Irwin, Inc., 1988, $25.95 paper).

S. Paul Garner, *Evolution of Cost Accounting to 1925*, Foundations of Accounting Series (New York and London: Garland Publishing, Inc., 1988, pp. xiv, 416, $43.00).

Michael Gendron, *A Practical Approach to International Operations* (New York; Westport, CT; and London: Quorum Books, 1988, pp. 208, $39.95).

John J. Glynn, *Public Sector Financial Control & Accounting* (Oxford and New York: Basil Blackwell, 1988, pp. 278, $19.95).

Robert E. Grasing and Michael H. Hessick, *Achieving Quality in Financial Service Organizations: How to Identify and Satisfy Customer Expectations* (New York; Westport, CT; and London: Quorum Books, 1988, pp. 264, $39.95).

Jack Gratus, *Successful Interviewing: How to Find and Keep the Best People* (New York: Penguin Books, 1988, pp. 93, $5.95 paper).

Rowan Jones and Maurice Pendlebury, *Public Sector Accounting*, Second Edition (London: Pitman Publishing, 1988, pp. 276, £12.95 paper).

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1989 Distinguished International Visiting Lecturers in Accounting

Abhulimen R. Anao

William R. Kinney, Jr.

The American Accounting Association is pleased to announce the selection of its 1989 Distinguished International Visiting Lecturers in Accounting. Abhulimen R. Anao, Professor of Accounting at the University of Benin, Benin, Nigeria, was selected as the Distinguished Lecturer to visit schools in the United States and Canada in April of 1989. William R. Kinney, Jr., Professor of Accounting at the University of Texas at Austin, was selected as the professor from the United States or Canada to visit educational institutions in France, Greece, Italy, Spain, Turkey, and Yugoslavia.

The American Accounting Association is appreciative of the financial support this program receives from Exxon Corporation and Ford Motor Company Fund. This program was started with an Exxon Controller's Grant in 1975. This year, the Exxon Controller's Grant and contribution from the Ford Motor Company Fund will provide $7,500 to the American Accounting Association for financial support connected with this program. Under the Distinguished International Visiting Lecturer in Accounting Program, a distinguished professor from the United States or Canada lectures for several days at eight or nine universities in certain areas of the world and a distinguished professor from abroad lectures for two days at each of eight universities in the United States and Canada.

The American Accounting Association's International Faculty Exchange Committee, which makes the selections of the distinguished professors and universities to be visited, is appointed by the President of the American Accounting Association. Individuals interested in being considered as a future Distinguished International Visiting Lecturer in Accounting should send a letter expressing their desire to the Executive Director of the American Accounting Association. Interested parties may also nominate potential future Distinguished International Visiting Lecturers for consideration by the selection committee. In addition, universities in the United States and Canada which might be interested in hosting a future Distinguished International Visiting Lecturer in Accounting from abroad are encouraged to notify the Executive Director of the Association of their interest.

Abhulimen Anao will serve as the Distinguished International Visiting Lecturer who will visit the United States and Canada in April of 1989. He will visit the following universities: Virginia Polytechnic Institute and State University, University of Delaware, University of Notre Dame, The Ohio State University, Queens University, The University of South Dakota, The University of Texas at Austin, and Tulane University.

Abhulimen R. Anao has been a member of the American Accounting Association since 1977. In addition, he is a member of the Institute of Management Consultants of Nigeria, the Institute of Chartered Accountants in Nigeria, and the Chartered Association of Certified Accountants (Great Britain). He has taught at the University of Benin since 1976 and was named full Professor of Accounting in 1981. He received his B.S. in Accountancy with First Class Honors from the University of Nigeria in 1965 and the M.A. (Economics) from the University of Manchester in 1970.

Prior to joining the University of Benin, Abhulimen Anao served as a Senior Consultant to Nigerian Economic Welfare Services Limited, Assistant Controller (Corporate Finance) of the Nigerian Industrial Development Bank Limited, and as Senior Accountant/Assistant to the Controller of Shell-BP Petroleum Development Company Limited. Abhulimen Anao is author or coauthor of three books and numerous journal articles and technical reports. He is Editor-in-Chief of the Benin Journal of Social Sciences and has been very active at the University of Benin, having served in many major administrative assignments and on various university committees. Professor Anao's research interests include accounting theory, financial management, and management development and training.

William R. Kinney, Jr., is Professor of Accounting at the University of Texas at Austin. He received the B.S. and M.S. degrees from Oklahoma State University and the Ph.D. from Michigan State University. He holds a CPA certificate in Oklahoma. William Kinney has also held teaching appointments at the University of Iowa, Oklahoma State University, and the University of Michigan. William Kinney received the John R. Wildman Medal in 1983 for his contributions in the area of statistical sampling in auditing. He was Faculty Vice President of Beta Alpha Psi from 1981 to 1983, and has served on several committees of the American Accounting Association, including the Committee to Respond to the SEC, the Auditing Standards Committee, the Competitive Manuscript Award Committee, and the Wildman Award Committee. Professor Kinney is a member of the American Accounting Association, the American Institute of CPAs, the Iowa Society of CPAs, and the American Statistical Association. He has served on the Editorial Boards of several journals, including *The Accounting Review* (1977–1980). In addition to having been an Associate Editor of *The Accounting Review*, William R. Kinney, Jr., is presently serving in his third year as Editor of *The Accounting Review*. He is the author of numerous articles in professional journals. William Kinney joined the American Accounting Association in 1968 and was elected Director of Research of the AAA for 1984–1985 and 1985–1986. He has served on the faculty of the Doctoral Consortium on several occasions, the most recent being the 1988 Doctoral Consortium.

William Kinney will lecture at universities in France Greece Italy Spain Turkey and Yugoslavia this Spring

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APRIL 1989 PLACEMENT ADS

The deadline for information to be included in the "Placement Information" section is two months prior to the date of publication. The Review *is published on the first day of January, April, July, and October. Placement advertising and replies should be sent to the American Accounting Association, 5717 Bessie Drive, Sarasota, FL 34233. ATTENTION: ADVERTISING DEPT. All replies to box numbers should be on separate sheets to facilitate forwarding. There is no charge for this service to AAA members and associate members seeking employment. Others will be charged a fee of $150 per insertion. ADS SHOULD NOT EXCEED 150 WORDS.*

#201 ACCOUNTING FACULTY, EASTERN MICHIGAN UNIVERSITY. A dynamic University in a dynamic business environment, Eastern Michigan University College of Business in a high-tech Ann Arbor area, is seeking motivated faculty holding doctoral degrees in accounting to fill tenure-track positions. Responsibilities include: teaching at the undergraduate and master's levels, participating in student affairs, research and writing, and professional development. Rank is dependent upon qualifications. ABD will be considered. Salary and benefits are very competitive. For consideration, send detailed resumé to: Position: ACCTG. Faculty, 310 King Hall, Human Resources, EASTERN MICHIGAN UNIVERSITY, Ypsilanti, MI 48197. (313) 487-3320. We take pride in the pursuit of our affirmative action objectives and encourage qualified women and minorities to consider this opportunity. Multicultural experience desired.

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#203 THE UNIVERSITY OF SOUTH FLORIDA is seeking qualified applications for a tenure-track faculty position on the Tampa campus beginning August 1989. Candidates are expected to possess a doctoral degree and should be dedicated to teaching excellence and scholarly research. Applications should be sent to: Professor Jack L. Smith, School of Accountancy, University of South Florida, Tampa, FL 33620-5500. The University of South Florida is an Equal Opportunity/Affirmative Action Employer.

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#206 CALIFORNIA STATE UNIVERSITY, SACRAMENTO has accounting faculty openings, effective August 1989, in its accredited AACSB undergraduate and master programs. Salary and rank open, commensurate with academic preparation and professional experience. For tenure-track positions, applicants must hold a doctoral degree with specialization in accounting; professional experience and/or certification are desirable. Primary emphasis is on teaching effectiveness; research and scholarly activities are required. Applicants in final stages of doctoral study may be considered for nontenure-track positions that may be converted to tenure-track if the doctorate degree is completed during the term of appointment. Send application letter and resumé to Chair, Department of Accountancy, School of Business and Public Administration, California State University, 6000 J Street, Sacramento, CA 95819-2694. The Department will begin to review applications on Friday, September 30, 1988 until each position is filled. CSU, Sacramento is an Equal Opportunity/Affirmative Action/Handicapped/Title IX/Vietnam ERA Veteran Employer.

#207 TENURE-TRACK POSITIONS IN ACCOUNTING, Rutgers, The State University of New Jersey, Department of Accounting in Newark invites applications for tenure-track positions in the following areas: Financial, Managerial, Governmental/Social. Positions carry appointments at the Assistant/Professor levels, reduced teaching load and modest advisement and other departmental responsibilities. We are particularly interested in applicants who are committed to careers in teaching and can demonstrate ability in (or potential for) outstanding research and publication. The Department has adequate resources to support such interests and activities. Applicants should have an earned doctorate in an appropriate field of study (ABD status may be acceptable), experience in teaching and accounting practice and a professional certificate/license. Salary and benefits competitive. Travel support, research assistants, and compensated annual leaves available. Submit full curriculum vitae to Dr. David J. Zaumeyer, CPA, Chairman, Department of Accounting, 214 Bradley Hall, Newark, New Jersey 07102. Rutgers is an Equal Opportunity/Affirmative Action Employer.

#208 THE UNIVERSITY OF ALABAMA AT BIRMINGHAM (UAB) is seeking applications for appointment at the Assistant and Full Professor level in Accounting. Applicants for Assistant should possess a Ph.D. or D.B.A. ABD's will be considered. Applicants for Full Professor must have an outstanding record in teaching, research, and professional involvement. Contingent on funding, the Full Professor position (visiting or permanent) would be available for 1989–90, and the Assistant position for 1990–91. UAB is an Equal Opportunity/Affirmative Action Employer and holds separate accounting accreditation at the undergraduate and graduate levels. Contact: Dr. Loudell Robinson, UAB, Department of Accounting, University Station, Birmingham, AL 35294.

#209 WRIGHT STATE UNIVERSITY invites applications for a tenure-track accounting position at the Assistant Professor level beginning September 1989. Candidates should possess a doctorate in accounting or be nearing completion of degree. Professional certification desirable. Salary competitive; excellent fringe benefits. Undergraduate business and MBA programs are AACSB accredited. Apply to: Jim Snavely, Chair, Department of Accountancy, College of Business and Administration, Wright State University, Dayton, Ohio 45435. Telephone (513) 873-2387. Application deadline: December 1, 1988 or until position is filled. Wright State University is an EO/AA.

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#211 THE SCHOOL OF ACCOUNTING AT OKLAHOMA STATE UNIVERSITY announces the Kerr-McGee Chair in Accounting and seeks applicants for this position. Applicants should possess a distinguished record of research and teaching and be capable of assuming a major role in the academic and professional mission of the School. Activities of the professor are expected to include teaching and conducting scholarly research, contributing to the research activities of the faculty, and active participation in the doctoral program. The initial appointment is five years, renewable thereafter at three-year intervals. Benefits beyond the resources and privileges accorded School of Accounting faculty include a generous salary supplement, a six-hour per semester teaching load, and summer research support. Applicants should send resumés to Dr. Lanny G. Chasteen, Head, School of Accounting, Oklahoma State University, Stillwater, OK 74048-0555. OSU is an equal opportunity, affirmative action employer.

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#214 ONE TENURE-TRACK POSITION IN ACCOUNTING FOR SEPTEMBER, 1989, subject to budgetary approval. Auditing, Managerial Accounting, Financial Accounting, Information Systems and Computer Applications in Accounting, Advanced Seminars in Theory and Research are preferred fields, but others will also be considered. Position requires a commitment to teaching, research, and service. Queens College is an equal opportunity/affirmative action employer. Applications received by May 30 will receive the highest priority. CURRICULUM VITA MAY BE FORWARDED BY MAIL DIRECTLY TO: Dr. Arthur Adelberg, Chairman, Department of Accounting and Information Systems, PH 109, Queens College of the City University of New York, 65-30 Kissena Boulevard, Flushing, New York 13672.

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Earnings and Stock Splits

Paul Asquith, Paul Healy, and Krishna Palepu

ABSTRACT: This paper examines whether stock splits convey information about earnings. The results indicate that firms split their shares after a significant increase in earnings. Before the stock split announcement, the market expects these earnings increases to be temporary. The split announcement leads investors to increase their expectations that the past earnings increases are permanent. The evidence also suggests that the market's reaction to split announcements cannot be attributed to expectations of either future earnings increases or near-term cash dividend increases.

STOCK splits have long been a puzzling phenomenon to financial economists. Stock splits usually occur after an increase in stock prices and usually elicit a positive stock price reaction upon announcement.[1] The reason for this announcement reaction, however, has not been fully understood. Since stock splits themselves do not directly affect a company's cash flows, the increase in a company's stock price at the time of these announcements must, assuming market efficiency, reflect the release of new information. An explanation first proposed by Fama et al. [1969] and repeated in subsequent studies is that the market interprets stock split announcements as improving the probability of near-term dividend increases.[2]

Fama et al. [1969] report data consistent with the dividend explanation: 71.5 percent of their sample firms experience a percentage dividend increase in the year after the split which is larger than the average increase for all securities on the New York Stock Exchange. Thus, they argue that a large price increase at the time of a stock split is due to altered expectations concerning future dividends rather than due to any intrinsic effects of the splits themselves.

This "dividend hypothesis," however, does not appear to fully explain the ob-

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[1] The seminal study by Fama et al. [1969] documents stock price increases prior to the split. Bar-Yosef and Brown [1977], Charest [1978], Foster and Vickrey [1978], Woolridge [1983], and Grinblatt et al. [1984] all report positive stock price reactions to split announcements.

[2] Dividend increases, as studies subsequent to Fama et al. [1969] showed, cause stock prices to increase (e.g., see Aharony and Swary [1980] and Asquith and Mullins [1983]).

We wish to thank Robert Holthausen, Robert Kaplan, Bill Kinney, Richard Leftwich, Robert Merton, Richard Ruback, Karen Wruck, and two reviewers for their comments on an earlier draft of this paper. We also wish to thank the participants at seminars at Harvard University, New York University, the University of North Carolina, and the University of Chicago. Finally, we wish to thank Lydia Magliozzi and Eric Wolff for their assistance in data collection.

Paul Asquith and Krishna Palepu, both at Harvard Business School; and Paul Healy, MIT Sloan School of Management.

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served market reaction to stock split announcements. For example, Grinblatt et al. [1984] report a significant stock price reaction to the announcement of stock splits by firms that do not pay cash dividends in the three years prior to the split. Since only 11 percent of their sample firms initiate a cash dividend during the year following the split, they conclude that the valuation changes associated with stock split announcements cannot be attributed totally to revised expectations about near-term dividend increases.

An alternative to the "dividend hypothesis" is that the information revealed by stock splits concerns earnings rather than dividends [Fama, 1976, p. 164]. Two types of earnings information could be conveyed by stock splits. First, splits could provide favorable information about improved future earnings performance. This "signalling hypothesis," discussed by Grinblatt et al. [1984] and Lakonishok and Lev [1987], is that stock splits are used by managers to convey favorable information to the market. However, splits can provide a credible signal of future performance only if it is costly for firms without favorable information to split their stock.[3]

A second type of earnings information that could be conveyed by splits concerns pre-split earnings. Lakonishok and Lev [1987] find that splitting firms have large earnings increases prior to the split. Prior research [Brooks and Buckmaster, 1980; Beaver et al., 1980; and Freeman et al., 1982] indicates that large earnings increases are usually transitory and followed by earnings decreases. Therefore, investors are likely to treat pre-split earnings increases as largely transitory at the time of their announcement. If split decisions are based on managers' superior information that pre-split earnings increases are permanent, then the split announcement will lead investors to revalue the pre-split earnings growth. One managerial motive for splits cited frequently by practitioners which is consistent with this hypothesis is that splits are used to keep stock prices within an optimal trading range.[4]

Earlier studies [Lakonishok and Lev, 1987; McNichols and Dravid, 1987] find evidence of dividend and/or earnings growth surrounding stock split announcements.[5] However, it is not possible to conclude from their findings that stock splits convey information about earnings since their sample firms also announce dividend increases prior to, and simultaneously with, the split announcements. Earlier papers find that dividend increases are accompanied by prior earnings growth and convey information on subsequent earnings [Offer and Siegel, 1987; Healy and Palepu, 1988]. Thus, it is not possible to distinguish the information conveyed by stock splits from that of simultaneous dividend announcements. Further, Lakonishok and Lev [1987] and McNichols and Dravid [1987] do not test whether there is a cross-sectional relation between the market reaction to the split announcement and the prior earnings growth.

This paper reexamines whether stock splits convey information about firms' earnings. In order to mitigate the confounding information effects of simultaneous dividend changes noted above, only firms that do not pay cash dividends at the time of the stock split are included in the sample. Further, we examine the cross-sectional relation between the information conveyed by the stock splits and surrounding earnings changes.

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[3] Brennan and Copeland [1987] suggest that one cost of splits is the increase in investors' transaction costs because of fixed commissions and the odd lots created by the splits.

[4] See, for example, Baker and Gallagher's [1980] survey of managerial motives for stock splits. Also, Lakonishok and Lev [1987] and Defeo and Jain [1988] provide empirical evidence on absolute share price levels which supports the concept of a "normal range."

[5] McNichols and Dravid [1987] examine analysts' earnings forecasts around stock splits and finds that there are statistically significant pre-split upward revisions.

Our tests, based on a sample of 121 stock split announcements from the period 1970–1980, lead to several conclusions. Stock splitting firms experience significant earnings increases for several years before the stock split. Even when their earnings are adjusted for industry performance, splitting firms experience significant earnings increases in the year prior to the split. These earnings increases are permanent, since they are not reversed for at least four years subsequent to the split. However, the association between annual changes in stock prices and contemporaneous earnings changes for the splitting firms is lower in the two years prior to the split than in "normal" years, indicating that the market views the earnings increases in these two years as likely to be transitory. Finally, cross-sectional tests indicate that the larger the earnings changes in the two years prior to the split, the larger is the market reaction to the split announcement. Thus, at the stock split announcement, investors appear to increase their expectations that past earnings increases are permanent rather than transitory.

There is evidence of significant earnings increases in the year of the split. However, the earnings changes in the four subsequent years are insignificant. Also, we find no relation between stock split announcement returns and post-split earnings changes. These findings are inconsistent with the hypothesis that splits signal future earnings increases. Finally, in the post-split years the percentage of splitting firms initiating cash dividends is similar to that for the population of all firms, indicating that the market's reaction to split announcements is not due to anticipation of near-term dividend increases.

The paper is organized as follows. The data and sample are described in the next section. Section II presents the hypotheses and Section III presents the tests and results. The paper's conclusions are discussed in Section IV.

I. DATA

An initial sample of stock splits is identified from the CRSP Daily Master file. To be included in the sample, a firm has to: (1) announce a stock distribution (designated by the firm as either a stock split or stock dividend) of at least 25 percent during the time period 1970–1980; (2) pay no cash dividends prior to or at the time of the stock distribution announcement; (3) not announce any other stock distribution of 25 percent or more in the five years prior to the event; (4) be listed on the New York or American Stock Exchange at the time of the event; (5) have stock price and return data available for the announcement date and two days prior to the event; and (6) have the stock distribution announcement date available in *The Wall Street Journal*, or on the CRSP Daily Master file.

Grinblatt et al. [1984] hypothesize that there are potentially different costs associated with stock distributions greater than 25 percent (stock splits) and those less than 25 percent (stock dividends). While stock dividends generally reduce firms' retained earnings, stock splits do not. The reduction of retained earnings for stock dividends creates a potential cost to the firm by making certain debt covenants more binding. This cost is absent for stock splits. Hence, stock dividends and stock splits may convey different information to the market. Results of Grinblatt et al. [1984] and Lakonishok and Lev [1987] support this proposition. The present sample comprises only distributions that do not affect retained earnings.[6]

Cash dividend paying firms that split their stock often make contemporaneous announcements concerning dividend changes. The sample is, therefore, restricted to non-cash dividend paying firms in order to separate the earnings information conveyed by stock splits from the information conveyed by cash dividend announcements.[7] The restriction of no other stock distributions in a five-year period is to insure independence of observations in the sample since five years of prior earnings are analyzed with each split. Listing on the AMEX or the NYSE is required to guarantee data availability. Announcement dates are necessary to properly determine the market's reaction.

For each firm in the initial sample the following additional data are collected: (1) stock prices at the beginning of each of the five years before and five years following the split announcement, and for two days prior to the split announcement; (2) returns on the firm's common stock, and on the CRSP equally-weighted market index, for five years before and five years following the split announcement; (3) the first quarterly earnings announcement date preceding the split announcement; and (4) earnings per share before extraordinary items and discontinued operations from the 24 quarterly announcements immediately preceding the split date (to construct earnings for years -6 to -1), and the 20 quarterly announcements following the split date (to construct earnings for years 0 to 4).[8]

Annual earnings are defined so that year 0 earnings are computed from the four quarterly announcements subsequent to the split (quarters 0 to 3); year -1 earnings are constructed from the four quarterly earnings reports prior to that event; and the earnings for years -6 to -2 and 1 to 4 are constructed using the quarterly earnings data from quarters -24 to -5, and from quarters 4 to 19. Defined this way, the earnings for years -6 to -1 are announced strictly before the split announcement, and the earnings for years 0 to 4 are announced strictly after the split date. This is done because stock split announcements occur throughout a fiscal year and fiscal year earnings include some quarters before the split and some quarters after the split. By using quarterly data to create annual event earnings the earnings can be aligned with the split announcement and earnings performance before and after the announcement can be strictly separated.

Thus, to be included in the final sample a firm has to satisfy the following conditions: (1) the date of the quarterly earnings announcement immediately preceding the split announcement is reported in *The Wall Street Journal Index*, and (2) earnings for two or more

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[6] See American Institute of Certified Public Accountants [1953, Chapter 7B] for a more complete discussion of the accounting rules for stock distributions. Companies have some discretion in applying these accounting rules. For example, distributions greater than 25 percent can be accounted for as large stock dividends, thus reducing retained earnings. However, none of the firms in the present sample uses this treatment.

[7] This sample selection does not rule out the possibility that split announcements implicitly provide information on subsequent dividend changes. This issue is examined in the empirical test of hypothesis H4.

[8] Stock price and return data are collected from the CRSP files, announcement dates are collected from *The Wall Street Journal Index*, and earnings are collected from Quarterly COMPUSTAT files. Earnings, price, and return data are not available for all the sample firms for all years. For years before the stock split, data for some sample firms are not available on the CRSP or COMPUSTAT files primarily because the firm was not listed on either NYSE or AMEX. For years after the stock split, data are not available primarily because firms were delisted, merged, or liquidated. The actual number of firms for which usable data are available is indicated in the results tables discussed later in the paper.

TABLE 1

DISTRIBUTION OF STOCK SPLITS IN THE PERIOD 1970 TO 1980 BY YEAR FOR 121 FIRMS THAT DO NOT PAY CASH DIVIDENDS[a]

Year	*Number of Firms*	*Percent of Total Sample*
1970	10	8.3
1971	28	23.1
1972	29	24.0
1973	2	1.7
1974	1	0.8
1975	5	4.1
1976	6	5.0
1977	1	0.8
1978	9	7.4
1979	6	5.0
1980	24	19.8
Total	121	100.0

[a] To be included in the sample, firms have to meet the following requirements: (1) the firm made a stock split or stock dividend of at least 25 percent; (2) the firm did not pay cash dividends prior to or at the time of the dividend announcement; (3) no other stock dividend or split of 25 percent or more had been made in the five years prior to the event; (4) the firm is listed on the New York or American Stock Exchange; (5) the stock split announcement date is available in *The Wall Street Journal*, or on the CRSP Daily Master file; (6) stock price and return data are available for the announcement date and two days prior to the event; (7) the first quarterly earnings announcement preceding the event is reported in *The Wall Street Journal*; and (8) at least two years of consecutive quarterly earnings data are available on COMPUSTAT for the six years before and the five years after the event date.

years can be constructed from the Quarterly COMPUSTAT Industrial tapes.

The final sample consists of 121 firms that do not pay cash dividends and announce a stock distribution of at least 25 percent during the period 1970–1980. Table 1 reports the number of stock splits by calendar year. About 55 percent of the sample stock splits are from the three-year period 1970–1972; another 20 percent are from the year 1980; the remaining 25 percent are from the years 1974–1979. Thus, there is evidence that the splits are clustered in time.

To test whether any observed earnings patterns of the sample firms are due to industry and time-related trends, industry data on earnings per share before extraordinary items and discontinued operations are also collected for each final sample firm. The industry for each sample firm is defined as the set of firms listed on Standard and Poor's COMPUSTAT Industrial tapes with the same four-digit SIC Code.[9]

II. HYPOTHESES

Since stock split announcements follow and are contemporaneous with stock price increases, assuming market efficiency, they must reveal new information about the firm. This paper examines three types of information that could be conveyed by stock splits. First, splits could provide favorable information about improved future earnings performance. Second, splits could convey favorable information on pre-split earnings. In particular, if splitting firms experience prior earnings growth, a split could indicate that managers view these increases as permanent, rather than transitory. Finally, splits could provide information on increases in near-term dividends.[10]

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[9] Industry earnings data are constructed from annual, rather than quarterly, COMPUSTAT files. Since this file does not construct a quarterly Research tape, use of COMPUSTAT quarterly data will lead to exclusion of delisted firms from the inustry earnings. This problem is avoided by using COMPUSTAT Annual Industrial and Research tapes. One limitation of this approach is that the time period definitions for the sample firms' earnings may differ marginally from those for the industry figures.

The first of the above hypotheses is discussed by Grinblatt et al. [1984] and Lakonishok and Lev [1987]. They argue that if managers have superior information to investors on firms' performance, stock splits may be used to convey favorable information to the market. However, splits can only provide a credible signal of future performance if it is costly for firms without favorable information to split their stock.

To test whether stock splits convey information on future performance, earnings changes in years subsequent to splits are examined. Prior studies of the usual time-series behavior of annual earnings (e.g., Ball and Watts [1972] and Watts and Leftwich [1977]) suggest that annual earnings follow a random walk. Thus, the average earnings change for a random sample of firms is expected to be zero. However, if stock splits communicate favorable information about future earnings, average earnings changes for splitting firms subsequent to the split are expected to be positive. Two hypotheses are tested in the paper to evaluate whether splits provide information on subsequent earnings performance:

H1: Firms that split stock experience significant earnings increases in the years subsequent to the split announcement.

H2: The market reaction to the announcement of a stock split is positively related to the earnings changes subsequent to the split.

As noted above, splits can convey information about pre-split, rather than post-split, earnings. Brooks and Buckmaster [1980], Beaver et al. [1980], and Freeman et al. [1982] report that firms with large earnings increases in one year are likely to experience earnings declines in the following year. In other words, large earnings changes are usually transitory and followed by earnings decreases. Beaver et al. [1980] also report that, since large earnings increases are partially transitory, investors do not fully incorporate them into a firm's future expected earnings. Hence, if there are earnings increases prior to the stock split announcement, investors may attach a low probability to these earnings increases being permanent. The stock split may indicate to investors that managers expect pre-split earnings increases to be permanent.

To test whether stock splits convey information on pre-split earnings, the following three hypotheses are tested:

H3: Firms that split stock experience significant earnings increases in the years prior to the split announcement and no earnings declines in the post-split years.

H4: The market reaction to the announcement of a stock split is positively related to the earnings increases prior to the split.

H5: The relation between annual abnormal stock returns and contemporaneous earnings changes is lower than normal in years prior to the split.

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[10] Alternatively, the split could provide information about the firm's risk. This paper does not investigate this hypothesis.

Hypotheses H3 and H4 are similar to hypotheses H1 and H2, but examine pre-split, rather than post-split, earnings. Hypothesis H5 examines the relation between annual unexpected returns and contemporaneous earnings changes. Prior studies (e.g., Ball and Brown [1968] and Beaver et al. [1980]) find that there is a positive relation between unexpected returns and earnings. However, if investors discount pre-split earnings increases as largely transitory, there will be a lower than normal price to earnings elasticity for these years.

In addition to the above earnings hypotheses, H1 to H5, this paper also provides some evidence on the "dividend hypothesis" originally proposed by Fama et al. [1969] and subsequently discussed by Grinblatt et al. [1984] and Lakonishok and Lev [1987]. That is:

H6: The stock market responds positively to stock splits because they usually mean increased near-term cash dividends.

III. RESULTS

Market Reaction to Stock Split Announcements

Table 2 reports market-adjusted and raw returns around the announcement of stock splits. Market-adjusted returns are computed using the CRSP equal-weighted market index.[11] The split announcement day (AD) is the date *The Wall Street Journal* reports the stock split. The mean market-adjusted returns are insignificant for the period AD−480 to AD−251 days and significant for days AD−240 to AD−2. The holding period abnormal returns for days AD−240 to AD−121, AD−120 to AD−61, AD−60 to AD−21, AD−20 to AD−11, and AD−10 to AD−2 are all positive and significant. The cumulative abnormal returns from AD−240 to AD are 56.8 percent. The cumulative raw returns for this period are 66.4 percent. Thus, stock split announcements are preceded by large increases in the announcing firms' stock prices.

During the two days surrounding the split announcement (AD−1 and AD), the mean market-adjusted return is 3.7 percent, which is significantly different from zero at the 1 percent level. The median abnormal return is similar (3.5 percent). Further, 76 percent of the sample firms have positive abnormal announcement period returns. Controlling for other information announced simultaneously with the stock split (i.e., earnings, announcements, and financing announcements) increases the mean market-adjusted return to 4.4 percent for 84 firms and the percentage of firms with positive abnormal returns to 78 percent.[12] Finally, the abnormal returns for the 20 days subsequent to the stock split announcement are insignificant.

The abnormal returns in Table 2 are similar to those reported by earlier studies. For example, Fama et al. [1969] report a cumulative abnormal return of 35.8 percent during the 29 months preceding the stock split announcements in their sample. Grinblatt et al. [1984] report a 3.41 percent mean two-day an-

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[11] We also compute risk-adjusted returns for the same period. The results are similar in both size and significance levels to those reported here.

[12] While the clean announcement sample excludes observations with other contemporaneous news releases, it may also introduce a selection bias, the effect of which is unknown. The discussion of subsequent tests, therefore, emphasizes the full sample results even when clean announcement sample results are also reported.

TABLE 2

RAW AND MARKET-ADJUSTED RETURNS FOR VARIOUS HOLDING PERIODS SURROUNDING STOCK SPLIT ANNOUNCEMENTS BY FIRMS THAT DO NOT PAY CASH DIVIDENDS[a]
(1970-1980)

	Raw Returns		*Market-Adjusted Returns*	
Holding Period[b]	*Mean*	*t-statistic*	*Mean*	*t-statistic*
Panel A. Full Sample:				
AD−480 to AD−361	13.4%	3.0[c]	12.4%	1.5
AD−360 to AD−241	7.6	1.7[d]	6.6	1.5
AD−240 to AD−121	20.6	4.7[c]	19.4	4.5[c]
AD−120 to AD−61	17.1	5.1[c]	13.4	4.4[c]
AD−60 to AD−21	18.0	7.1[c]	14.6	5.8[c]
AD−20 to AD−11	3.3	2.6[d]	2.5	2.0[d]
AD−10 to AD−2	3.7	3.1[c]	3.2	2.7[c]
AD−1 to AD	3.7	6.7[c]	3.7	6.8[c]
AD+1 to AD+10	0.2	0.2	0.3	0.2
AD+11 to AD+20	−0.1	−0.1	0.1	0.1
Panel B. Sample with No Other Announcements:				
AD−480 to AD−361	15.5%	2.7[c]	12.8%	2.6[c]
AD−360 to AD−241	8.3	1.4	6.8	1.4
AD−240 to AD−121	16.7	2.9[c]	16.3	3.3[c]
AD−120 to AD−61	15.5	3.8[c]	11.4	3.3[c]
AD−60 to AD−21	16.6	4.9[c]	13.1	4.6[c]
AD−20 to AD−11	4.5	2.7[d]	3.4	2.4[d]
AD−10 to AD−2	3.8	2.4[d]	3.5	2.6[d]
AD−1 to AD	4.5	6.3[c]	4.4	7.1[c]
AD+1 to AD+10	1.6	1.0	1.6	1.1
AD+11 to AD+20	0.2	0.1	0.4	0.3

[a] The full sample comprises 121 firms that announced stock splits or stock dividends of 25 percent or more in the period 1970–1980. The sample with no other announcements comprises 84 of these firms. Market-adjusted returns are computed using equal-weighted market returns.

[b] The holding periods are for days relative to *The Wall Street Journal* announcement of the split (AD).

[c] Significantly different from zero at the 0.01 level (two-tailed test).

[d] Significantly different from zero at the 0.05 level (two-tailed test).

nouncement return for a large sample of stock split and stock dividends.

Earnings Performance Before and After Stock Splits

To determine whether there is a systematic earnings pattern for firms that split stocks, earnings changes are estimated for five years before (years −5 to −1), the year of the stock split announcement (year 0), and four years subsequent (years 1 to 4). As mentioned above, all earnings are calculated annually for the four quarters relative to the split announcement.[13] To aggregate results across firms, earnings changes are standardized for each firm j in years −5 to 4 by its stock price two days before the announcement of the stock split, P_j. The

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[13] Since stock splits occur throughout a fiscal year and since quarterly earnings are used, this method ensures that all earnings in year 0 are announced after the stock split. This analysis is repeated using fiscal year earnings data and the results are similar.

Table 3

Summary Statistics on Changes in Earnings Per Share as a Percentage of Initial Equity Price for Years Surrounding Announcements of Stock Splits by Firms that do not Pay Cash Dividends[a,b]
(1970-1980)

Period Relative to Stock Split	*Number of Firms*	*Mean*	*Student* t *Probability*[c]	*First Quartile*	*Median*	*Third Quartile*
Panel A. Raw Earnings Changes:						
Year −5	35	0.61%	0.57	−0.17%	0.58%	1.44%
−4	44	1.05	0.02	−0.26	0.41	1.29
−3	61	0.66	0.12	−0.56	0.37	1.63
−2	84	1.24	0.01	0.15	0.92	2.32
−1	100	2.55	0.01	0.76	1.37	2.52
0	118	2.03	0.01	0.65	1.28	2.88
1	117	0.91	0.17	−0.65	0.93	2.16
2	110	−0.65	0.32	−2.43	0.56	2.28
3	101	2.10	0.11	−1.40	0.55	4.13
4	98	2.82	0.15	−0.87	1.26	4.65
Panel B. Industry-Adjusted Earnings Changes:						
Year −5	33	0.90%	0.38	−1.70%	0.06%	1.55%
−4	42	0.06	0.90	−1.67	−0.60	0.64
−3	56	−0.48	0.37	−2.46	−0.57	1.37
−2	77	0.09	0.83	−1.33	0.26	1.43
−1	93	2.82	0.01	−0.18	0.74	2.17
0	109	−0.03	0.97	−1.34	0.27	1.80
1	108	−0.45	0.52	−2.39	−0.36	1.15
2	100	−0.63	0.39	−2.99	0.24	2.07
3	91	2.94	0.05	−2.36	1.33	4.26
4	88	1.22	0.58	−4.65	0.75	4.20

[a] The stock split sample comprises 121 firms that announced stock splits of 25 percent or more in the period 1970 to 1980. Earnings changes are not available for three of the split firms in year 0 since they do not have earnings data available in year −1. Industry-adjusted earnings changes are available for 109 of these firms. Industry-adjusted earnings changes for a given firm in year *t* are defined as the difference between the standardized earnings change for the split firm in year *t* and the median standardized earnings change for other firms in the same industry in that year.

[b] Earnings changes are estimated using quarterly earnings for the 24 quarters prior to the split announcement and the 20 quarters subsequent. Changes in earnings per share before extraordinary items and discontinued operations are standardized by the firm's stock price two days prior to the announcement of the stock split.

[c] Student *t*-test statistics test the hypothesis that the mean earnings changes are different from zero. The probability levels are for two-tailed tests of significance.

standardized earnings change in year t, $\Delta E_{j,t}$, is therefore defined as:

$$\Delta E_{j,t} = (A_{j,t} - A_{j,t-1})/P_j \qquad t = -5,\ldots,4 \qquad (1)$$

where $A_{j,t}$ is earnings before extraordinary items and discontinued operations for firm j in year t. Student t-statistics are calculated to indicate whether the mean standardized earnings changes of the stock split sample firms are significantly different from zero in each year.

Panel A in Table 3 reports the mean and quartile earnings changes and the number of firms for which data are available for the stock split sample in years −5 to 4.[14] The mean standardized earnings changes for years -4 to 0 are 1.05 percent, 0.66 percent, 1.24 percent, 2.55 percent, and 2.03 percent, respectively. These values are significant at the 2 percent level or better in four of the five years; the mean for year -3 is significant at the 12 percent level. Mean earnings changes are insignificant in years 1 to 4.[15]

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[14] The number of firms for which there is usable earnings data varies across years −5 to 4: the lowest is 35 firms in year −5 and the highest is 118 firms in year 0.

The above results indicate that firms that announce stock splits experience a significant earnings increase for the four years before the stock split announcement. The largest of these increases occurs in the year immediately before the stock split announcement. The earnings continue to increase during the year of the split. While earnings increases cease in the one year subsequent to the stock split, past increases are not reversed in those years. Therefore, the split firms' earnings increases prior to and contemporaneous with stock split announcements appear to be permanent.

Since the splits in the sample are clustered in time, it is possible that the earnings performance of the split firms is due to industry- and time-related factors rather than firm-specific factors. To test this, the split firms' performance is compared to the performance of their industries. For each sample firm, industry earnings changes for years -5 to 4 are estimated using all firms that (1) have the same four-digit SIC code on Standard and Poor's Annual COMPUSTAT and Research Industrial tapes, and (2) have earnings data available for two consecutive years of the 11 years surrounding a split announcement. The earnings changes for these comparison firms are then standardized by their stock prices two days prior to the test firm's split announcement and an industry median is constructed. Industry-adjusted earnings in each year are calculated for each splitting firm by subtracting its industry median earnings change from the firm's earnings change.

Panel B of Table 3 reports the mean and the quartile industry-adjusted earnings changes. The mean industry-adjusted earnings changes are insignificant in all years except -1 and 3. The mean-adjusted earnings change is 2.82 percent in year -1 and 2.94 percent in year 3, both significant at the 0.05 level or better. These results indicate that the strong earnings performances of the splitting firms are matched in general by their industries' performances. The split firms are in industries that have been experiencing good times. In the pre-split period, split firms perform significantly better than their industries only in year -1. This superior earnings performance by splitting firms relative to their industries is permanently incorporated into their earnings levels: in the years subsequent to the split announcements, the split firms do not experience significantly lower earnings growth than their industries.

The above results are similar to those of Lakonishok and Lev [1987], who examine earnings growth rates around stock splits. However, their sample includes firms that have contemporaneous cash dividend increases, making it difficult to relate the earnings growth to the splits *per se*. This limitation is mitigated in the

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The number of observations is low in years -5 to -2 mainly because many of the firms in the sample are newly listed at the time of the stock split and, therefore, do not have earnings data in these years; the number of observations after year 3 declines principally because of delistments. Of the 86 firms with unavailable data in year -5, 73 are not listed on the NYSE or AMEX and 13 are unavailable on COMPUSTAT. Of the 23 firms with unavailable data in year 4, six are acquired, two are liquidated, five are delisted by the exchange, two are suspended by the exchange, and eight are unavailable on COMPUSTAT.

[15] The mean earnings changes in years 3 and 4 are as large as years -1 and 0 but not as significant. This is due to increased cross-sectional volatility in earnings.

Table 4

Summary of Correlations Between Split Announcement Returns and Standardized Earnings Changes[a] Surrounding Stock Splits for Firms that do not Pay Cash Dividends[b]
(1970–1980)

Period Relative to Stock Split	*Number of Firms*	*Pearson Correlation Coefficient*	*Probability*	*Spearman Correlation Coefficient*	*Probability*
Year −5	35	−0.01	0.98	0.21	0.22
−4	44	0.03	0.83	0.01	0.93
−3	61	−0.05	0.71	−0.16	0.22
−2	84	0.29	0.01	0.32	0.01
−1	100	0.20	0.04	0.24	0.02
0	118	0.02	0.85	−0.09	0.34
1	117	0.00	0.99	−0.02	0.86
2	110	−0.12	0.25	−0.11	0.29
3	101	0.12	0.30	0.18	0.13
4	98	0.15	0.24	0.18	0.17

[a] The stock split sample comprises 121 firms that announced stock splits of 25 percent or more in the period 1970 to 1980. Earnings changes are not available for three of the split firms in year 0 since they do not have earnings data available in year −1.

[b] Earnings changes are estimated using quarterly earnings for the 24 quarters prior to the split announcement and the 20 quarters subsequent. Changes in earnings per share before extraordinary items and discontinued operations are standardized by the firm's stock price two days prior to the announcement of the stock split. The announcement return for each firm is the market-adjusted return, using equal-weighted market returns, for one day prior to and the day of the stock split announcement.

present analysis, since we examine firms that do not pay cash dividends.

To summarize, firms that announce stock splits experience significant earnings increases for several years prior to the year of the stock split announcements. In the year immediately prior to the split announcement, the split firms outperform their industries. This increase in earnings appears to be permament and is not reversed for at least four years after the split. These findings are consistent with hypothesis H3. In the post-split years, there are significant earnings increases only in the year of the split. This is weakly consistent with H1.

Stock Split Announcement Returns and Earnings Changes

This section examines whether there is a cross-sectional relation between the market's reaction at the announcement of a stock split and the earnings changes documented above (hypotheses H2 and H4). Table 4 reports the Pearson and Spearman correlation coefficients between the split announcement returns and the raw earnings changes (standardized by price) in each of the years −5 to 4. The announcement return for each firm is the market-adjusted return for one day prior to and the day of the stock split announcement. Standardized earnings changes in each year are computed as described above.

The Pearson correlation coefficients are insignificant in years −5 to −3 and 0 to 4. In years −2 and −1, the correlations are 0.29 and 0.20, both significantly different from zero. The Spearman rank correlation results are similar, indicating that the Pearson correlations are not

TABLE 5

TESTS OF THE RELATION BETWEEN STOCK SPLIT ANNOUNCEMENT RETURNS AND EARNINGS CHANGES SURROUNDING THE SPLIT FOR FIRMS THAT DO NOT PAY CASH DIVIDENDS[a,b]

(1970–1980)

$$SRET_j=\alpha+\beta_1\Delta E_{j,-2}+\beta_2\Delta E_{j,-1}+\beta_3\Delta E_{j,0}+\beta_4\Delta E_{j,1}+\epsilon_j$$

	Full Sample		*Sample with No Other Announcements*	
	Coefficient	*t-statistic*	*Coefficient*	*t-statistic*
α	0.03	3.7[c]	0.03	4.3[c]
β_1	0.29	2.0[d]	0.27	1.7[e]
β_2	0.25	2.1[d]	0.31	2.2[d]
β_3	−0.14	−1.17	−0.24	−1.5
β_4	0.04	0.62	0.07	1.1
R^2	0.115		0.132	
n	79		54	

[a] The stock split sample comprises 121 firms that announced stock splits of 25 percent or more in the period 1970 to 1980. Forty-two of the initial sample firms are excluded from the regression since they do not have earnings data available for each of the four years surrounding the split announcement. Sample with no other announcements comprises 54 of these firms.

[b] $\Delta E_{j,t}$ is the change in earnings in year t (estimated from quarterly earnings) standardized by the stock price two days prior to the stock split announcement; $SRET_j$ is the market-adjusted return for firm j for one day prior to and the day of the stock split announcement, estimated using an equal-weighted market index.

[c] Significant at the 0.01 level (two-tailed test).

[d] Significant at the 0.05 level (two-tailed test).

[e] Significant at the 0.10 level (two-tailed test).

driven by a few outliers. These correlations indicate that the split announcement returns are positively related to earnings increases for the two years prior to the split, consistent with H4. There is no relation between the announcement returns and the earnings changes after the split date even though year 0 has a significant earnings increase. This is inconsistent with H2.

The split announcement returns are also regressed on earnings changes in the two years before the split (years −2 and −1) and the two years after the split (years 0 and 1).[16] The following regression equation is estimated:

$$SRET_j=\alpha+\beta_1\Delta E_{j,-2}+\beta_2\Delta E_{j,-1}+\beta_3\Delta E_{j,0}+\beta_4\Delta E_{j,1}+\epsilon_j \quad (2)$$

where $SRET_j$ is the market-adjusted return for firm j for one day prior to and the day of the stock split announcement and $\Delta E_{j,t}$ is the earnings change in year t standardized by the stock price two days prior to the stock split announcement.

Table 5 reports regression estimates for both the full sample and the sample of firms that have no other simultaneous announcements. For the full sample, the estimated coefficients for earnings changes in years −2 and −1 are 0.29 and 0.25, both significantly different from zero at the 0.05 level in a two-tailed test. These estimates indicate that, all else being constant, a ten percent increase in standardized earnings in year −2 (year −1) is likely to be accompanied by a 2.9 percent (2.5 percent) market-adjusted return in the two days surrounding the stock split announcement. The coefficients of the earnings changes in years 0 and 1 are insignificant.[17] Results for the subsample with no other simultaneous announcements are similar to those for the full sample. The estimated coefficients for earnings changes in years −2 and −1 are significant at the 0.10 and 0.05 levels, and the coefficients for earnings in years 1 and 2 are insignificant.

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[16] The announcement returns are also regressed on earnings changes for longer periods. The results are not qualitatively different from those reported below. Only results for years −2 to +1 are reported because the number of usable earnings observations varies across years (see Table 4) and these years have the largest number of observations. Also, as the correlation results in Table 4 show, the other years' earnings changes are not related to the announcement returns.

The above results are consistent with hypothesis H4 and inconsistent with hypothesis H2. The information released by the stock split announcements is related to earnings increases in the two prior years, but not to subsequent earnings growth. One interpretation of these results is that when firms experience large earnings increases the market assumes that the increases are at least partially transitory. When splits are announced, the market revises upward the probability that the past earnings increases are permanent, leading to an increase in the firms' stock prices.

Abnormal Returns and Earnings Changes Surrounding Stock Splits

To investigate whether the market discounts earnings changes in the two years prior to a stock split, the relation between annual abnormal stock returns and earnings changes for years surrounding the stock split is estimated as follows:

$$AR_{j,t}=\lambda_0+\lambda_1\Delta E_{j,t}+\lambda_2\Delta E_{j,t}D_t+\epsilon_{j,t}\qquad t=-5,\ldots,4 \qquad (3)$$

where $AR_{j,t}$ is the annual market-adjusted return for firm j in year t, the difference between the firm's return and the return on the equal-weighted market index; $\Delta E_{j,t}$ is the change in earnings per share for firm j in year t deflated by stock price at the beginning of the year;[18] and D_t is an indicator variable that is one in years −1 and −2, and zero in all other years.

To illustrate the method used to compute annual returns, consider a company that announces a stock split on May 15, 1976. The quarterly earnings announcement immediately prior to the split is on April 16. The return for year −1 is the cumulative return for the year ending two weeks after the earnings announcement date, that is, April 30, 1976. The earnings for year −1 are the sum of the four quarterly earnings announced during this period. Defined this way, the year −1 return includes these four quarterly earnings announcements. If the split announcement occurred within two weeks of the earnings announcement, year −1 is defined as ending two days prior to the split date, May 13, 1976. Years −5 to −2 are the four years prior to −1; years 0 to 4 are the five subsequent years. Each of these years is expected to include the four quarterly earnings announcements used to compute

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[17] Specification tests are conducted to assess whether the residuals are homoscedastic, normally distributed, and cross-sectionally dependent. One cannot reject the hypotheses that the residuals are homoscedastic and normally distributed at the 0.05 level. To test whether the residuals are cross-sectionally dependent, regression observations are sorted by split announcement date. The Durbin-Watson statistic indicates that there is no significant residual cross-correlation.

[18] Annual earnings are constructed using quarterly earnings aligned in relation to the stock split announcement, as discussed above. However, in previous tests earnings changes were deflated by the stock price two days prior to the split announcement, whereas earnings changes in these tests are standardized by the beginning of each year price.

TABLE 6

TESTS OF THE RELATION BETWEEN ANNUAL MARKET-ADJUSTED RETURNS AND EARNINGS CHANGES IN YEARS SURROUNDING STOCK SPLITS FOR FIRMS THAT DO NOT PAY CASH DIVIDENDS[a,b]
(1970–1980)

$$AR_{j,t}=\lambda_0+\lambda_1\Delta E_{j,t}+\lambda_2\Delta E_{j,t}D_t+\epsilon_{j,t}$$

	Coefficient	*t-statistic*
λ_0	0.46	2.8[c]
λ_1	5.12	8.0[c]
λ_2	−5.18	−2.0[d]
Adjusted R^2	0.083	
n	705	

[a] The stock split sample comprises 121 firms that announced stock splits of 25 percent or more in the period 1970 to 1980.

[b] $\Delta E_{j,t}$ is the change in earnings for firm j in year t (estimated from quarterly earnings) standardized by the firm's stock price at the beginning of the year; $AR_{j,t}$ is the market-adjusted return for firm j for year t; and D_t is an indicator taking the value one in years −2 and −1, and zero otherwise.

[c] Significant at the 0.01 level (two-tailed test).

[d] Significant at the 0.10 level (two-tailed test).

earnings for that year. Actual earnings announcement dates in these years are not collected since there is evidence from prior studies that earnings announcement dates are stable across years [Chambers and Penman, 1984].

The coefficient λ_1 is the average price to earnings elasticity in years −5 to −3 and 0 to 4. Earlier studies find that this coefficient is positive [Ball and Brown, 1968]. The coefficient λ_2 measures the deviation of the price to earnings elasticity in years −2 to −1 relative to other years. If, as hypothesized in the previous section, the market discounts large earnings increases experienced by the split firms in years −2 and −1, λ_2 will be negative.

Table 6 presents results of the estimation of equation (3).[19] The estimate for λ_1 is 5.12 and is significant at the 0.01 level, indicating that on average there is a positive association between price and earnings changes. This implies that normally a one dollar increase in earnings is accompanied by about a five dollar increase in stock price. However, in the two years prior to the stock split, the relation between earnings and price changes is significantly lower, as indicated by the negative estimate for λ_2. During these two years, there is no linear relation between abnormal returns and changes in earnings.[20] This result is consistent with hypothesis H5, that investors view the earnings increases in these two years as transitory, rather than permanent.[21]

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[19] Specification tests are conducted to assess whether the residuals are homoscedastic, normally distributed, and cross-sectionally independent. One cannot reject the hypotheses that the residuals are homoscedastic and cross-sectionally independent at the 0.05 level, but one can reject the hypothesis that the residuals are normally distributed. This implies that the least squares estimates are still best linear unbiased and consistent, but the standard formulae for t- and F-tests are inappropriate. However, the central limit theorem implies that standard statistical tests are approximately correct for reasonably large samples, as in this case (see Pindyck and Rubinfeld [1976]).

[20] To determine whether there is a nonlinear relation between earnings and price changes in these years, we regressed the absolute value of $AR_{j,t}$ on the log of the absolute value of $\Delta E_{j,t}$. The estimated slope coefficient is positive and significant at the 0.01 level.

[21] We also test whether there is a difference in the relation between stock returns and earnings changes in years

Dividend Initiations Subsequent to Stock Splits

Hypothesis H6 suggests that the market's reaction to split announcements is due to an implicit signal about increased near-term cash dividend payments. Since our sample consists of firms that do not pay cash dividends at the time of the split, an increase in cash dividends implies dividend initiation. In order to investigate this possibility, the sample is followed for five years subsequent to the split and cash dividend initiations are recorded. Of the 121 firms in the sample, 81 (67 percent) do not initiate a cash dividend payment during the five years after the split announcement. Of the remaining 40, the mean (median) lag between the stock split announcement and the payment of the first cash dividend was 32 (34) months. Only 11 (9 percent) sample companies pay cash dividends within one year from the date of the stock split.[22]

The percentages of splitting firms that initiate cash dividends are similar to those for the population of all firms. For the sample period 1970–1980, 10 percent of the non-cash dividend paying firms listed on COMPUSTAT initiate dividends in any given year. Furthermore, 70 percent of the firms which do not pay cash dividends do not initiate dividends during the next five years. These results are inconsistent with hypothesis H6.

IV. SUMMARY AND DISCUSSION

Previous studies report significant stock price increases for firms that announce stock splits. Assuming market efficiency this implies that stock splits convey new information. This paper examines whether this information is related to earnings performance either before or following the split, or to cash dividend payments after the split.

The analysis leads to several conclusions. There are significant earnings increases in the four years before the stock split announcement. These earnings increases appear to be permanent since the earnings changes after the stock split announcement are either insignificant or positive for up to five years. Pre-split earnings increases are due to both industry and firm-specific factors. Firms that announce stock splits are in industries which perform well, but outperform their industries in the year prior to the split date. However, the market discounts the pre-split earnings growth, since the relation between stock price and earnings changes during the two years before the split is significantly lower than normal. The stock price reaction to firms' split announcements is related to their earnings increases in the two years prior to the splits, consistent with the hypothesis that split announcements lead to an upward revision in investors' probability assessments that pre-split earnings increases are permanent rather than transitory.

The significant stock price reaction to the sample of split announcements cannot be attributed to investors' expectations of post-split earnings or dividend

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0 and 1 for firms that have positive and negative earnings changes. If splits convey information on permanence of *earnings levels*, there should be no difference in this relation, since the market expects post-split earnings to have a mean of zero. If, on the other hand, splits provide information on permanence of *earnings growth*, the market will expect post-earnings changes to be positive. Price changes are, therefore, likely to be larger for earnings declines than earnings increases. The test results indicate that the association between price changes and negative changes in years 0 and 1 is not significantly different from the normal association between price and earnings changes.

[22] If the market responds to a 9 percent increase in the probability of dividend initiation in one year with a 3.2 percent abnormal return, this implies an extremely large response to dividend initiation announcements. However, Asquith and Mullins [1983] report that dividend initiation announcements elicit an abnormal return of only 3.7 percent.

increases. First, in the post-split period the firms show significant earnings increases only in the year of the split, and these are unrelated to the split announcement return. Second, the sample firms do not pay dividends prior to the split announcement, and the fraction of firms that initiate dividend payments within five years is similar to that for all COMPUSTAT firms.

Since the present sample of stock splits consists of firms that do not pay cash dividends, it is possible that the results are not applicable to stock splits by dividend-paying firms. For dividend-paying firms the market may use both dividend changes and stock splits to infer whether earnings changes are permanent. If so, stock splits by dividend-paying firms are likely to be less informative about earnings than those by non-dividend-paying firms.

The above results document that there is earnings information conveyed by stock splits. However, they do not necessarily explain managers' motives for splitting their firms' stocks. Managers may not view stock splits as a means of communicating earnings information. Irrespective of their motives, if managers use their superior information on the permanence of pre-split earnings growth in making split decisions, investors will interpret a split as confirming that past earnings are permanent, consistent with our results.

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Information Evaluation in a Competitive Environment: Context and Task Effects

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ABSTRACT: This paper reports the results of an experiment in which subjects assumed the role of division managers in a decentralized firm and made subjective information system choices. Existing subjective information evaluation research is extended by incorporating a two-person competitive environment and investigating the effects of context and task variables on information system choice. Consistent with previous studies, subjects' information system choices indicated misperception of information values, with overvaluation of information indicated more frequently than undervaluation. Deviations from predictions of a game-theoretic model occurred under conditions of state uncertainty. Choices of subjects playing a game with equivalent payoffs, but without state uncertainty, conformed to the model, for the most part. In addition, context did not have an aggregate effect on subjects' information system choices. However, alternative presentation modes for information system costs had differing effects on choices across contexts.

ACCOUNTANTS often face the task of evaluating alternative systems for generating "decision-facilitating" information; that is, information which is used to help resolve uncertainty in a problem prior to making a decision [Demski and Feltham, 1976, p. 9]. Accounting researchers have used the theory of information economics to develop criteria for the evaluation of such information systems. This theoretical framework assumes that individuals act consistently with the expected utility hypothesis. Experimental research has shown, however, that individuals' subjective evaluations of information systems are not always consistent with the values calculated using information economics [Hilton et al., 1981; Hilton and Swieringa, 1981; Schepanski and Uecker, 1983; and Uecker et al., 1985].

This paper examines the task of choosing a decision-facilitating information system in a multi-person setting in which

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individual objectives are in conflict. Subjects in the experiment assumed the role of one of two division managers in a decentralized firm. The subjects interacted with a microcomputer, which played the role of the other manager.

Two features distinguish the paper from previous research. First, it addresses the problem of subjective information evaluation in a two-person environment with conflicting individual objectives. Within such an environment, a private information system may affect the actions of the person without access to the system. Consequently, the value of information may differ from that in a single-person setting or in a multi-person setting where individual objectives are not in conflict [Baiman, 1975]. Current analytical models utilized in accounting research generally assume a multi-person environment with conflicting objectives [Baiman, 1982; Demski and Kreps, 1982]. However, experimental work in accounting has focused on single-person settings [Demski and Swieringa, 1981; Swieringa and Weick, 1982]. In particular, it is not known whether individuals consider strategic implications when deciding whether or not to choose a given information system.

Second, this paper investigates the effect of context and task characteristics on information evaluation behavior. Existing subjective information evaluation research has exclusively incorporated variables directly related to the economic demand value of information. However, the contexts in which information system evaluation problems are encountered often differ. Also, task characteristics, such as the manner in which the payoffs and costs associated with a system are presented, may vary. Results reported in studies of other decision problems involving uncertainty [Einhorn and Hogarth, 1981; Payne, 1982] suggest that subjective evaluations of information systems may be subject to context and task effects. These effects may occur instead of, or in addition to, the effects of the variables that enter into the calculation of the demand value of information.

The remainder of the paper is organized as follows. First, the relation of context and task variables to the information evaluation problem is discussed. Second, the experimental method and hypotheses are described. The third section presents the experimental results. The final section of the paper is a discussion of the results and conclusions.

THEORETICAL DEVELOPMENT

Schepanski and Uecker [1983] and Uecker et al. [1985] found that individuals consistently ascribed positive value to information systems, even when the economic demand value of these systems was zero. This research suggests that individuals may perceive the value of information as positive, even when it is not. However, other evidence on whether overvaluation is a general tendency is not clear. Hilton and Swieringa [1981] also found their subjects consistently overvalued information. On the other hand, Hilton et al. [1981] used a similar elicitation technique and reported that only a portion of their subjects overvalued information.

Inconsistencies between subjective valuations of information systems and their theoretical values may depend on context and/or task variables. *Context* effects in decision making research are synonymous with *content*, especially as it relates to the perceived values of the objects in a decision set under consideration [Payne, 1982, p. 386]. The context variable in this study is manipulated by making slight wording changes in an information evaluation problem, while maintaining the same basic problem structure. *Task* effects are associated with the *formal structure* of a decision problem. The task variable examined here is the presentation mode for information system costs. Information systems are either presented as "costly" (system costs shown as a separate item) or "costless" (system costs netted out of expected values).

Context Effects

Economic information evaluation models presume that responses should be consistent for problems with identical structures, regardless of the content or framing of the problems. Behavioral researchers assert, however, that content gives meaning to tasks and should not be ignored in trying to predict behavior [Einhorn and Hogarth, 1981, p. 61]. Indeed, context effects arising from slight wording changes have been demonstrated in a number of problems involving decision making under uncertainty, such as gambles for money, medical decisions about saving lives, and decisions whether or not to purchase insurance [Kahneman and Tversky, 1979; Tversky and Kahneman, 1981; Hershey and Schoemaker, 1980; and Slovic et al., 1982]. Since information evaluation is basically a decision to employ a system that will reduce or eliminate uncertainty, it may be subject to similar effects. There are two alternative premises tested in this study with respect to context.

The first premise is that individuals will overvalue information when presented with an explicit information acquisition decision, but not when the problem is presented in more general terms, e.g., as an opportunity to reduce uncertainty. This prediction is based upon the context effects in insurance purchase decisions observed by Hershey and Schoemaker [1980]. In that study, individuals responded differently when a problem was framed as a choice between a sure loss and a lottery with a loss component than when it was framed as a decision to pay an insurance premium to protect against loss. Given the same set of values in both problems, the majority of subjects chose the risky prospect in the gambling problem, while the majority decided to pay the premium in the insurance problem. One reason given for this result is content affects the way individuals view the problems, even though their structure is the same. The insurance purchase may be viewed as the purchase of protection (a valuable good), while the gamble in the lottery context is viewed as preferable to a certain loss [Einhorn and Hogarth, 1981; Slovic et al., 1982]. A similar context effect may occur in information evaluation problems. Individuals may view information as a valuable good when presented with an information evaluation context, but not in a generalized uncertainty reduction context. This effect may lead to information overvaluation in the first case, and evaluations consistent with economic models in the second.

The alternative premise is that individuals will overvalue information, regardless of context. This is supported by the notion that persons are uncomfortable with uncertain outcomes, thus finding the reduction or omission of uncertainty a useful cognitive simplification mechanism [Hogarth, 1975, p. 273]. Any mechanism that is thought to reduce uncertainty may be perceived as valuable, even though it may have no effect on final outcomes [Langer, 1977; Feldman and March, 1981].

Task Effects

The subjective information evaluation research discussed above focused upon elicitation of demand values. That is, experimenters determined the stated cost at which subjects would be indifferent between a given information system and no information. Within an organization, however, the stated cost of an information system to a user may or may not equal its expected value, or even the actual cost of implementing the system. For example, the costs of producing certain reports may be borne entirely by a data processing department within an organization. Alternatively, each division may be entirely responsible for its own information production costs.[1]

To give a simple example of a stated cost manipulation, consider the following problems (table values are outcomes; utility is linear):

Problem A

	s_1 ($p=0.6$)	s_2 ($p=0.4$)	*EU*
a_1	100	−25	50
a_2	−25	25	−5

Problem B

	s_1 ($p=0.6$)	s_2 ($p=0.4$)	*EU*
a_1	100	−25	50
a_2	−25	50	5

Assume that perfect information on the state outcome is costless in Problem A and is available for ten units in Problem B. This allows one to choose a_1 contingent on s_1 and a_2 contingent on s_2, yielding an expected utility of 70. Therefore, the expected utility of perfect information is ten units for both cases, indicating one should choose to act with information in both even though the stated cost of information is different.[2]

However, individuals may focus on stated cost in ways which are irrelevant, according to economic models [Aschenbrenner, 1978; Payne, 1982, p. 390]. They may use stated cost as an evaluation criterion within a simplified decision process, in lieu of expected value. Individuals following such an approach would set an arbitrary stated cost cutoff point beyond which they will not utilize information, regardless of its expected value. In the above case, assume that a person sets five units as the cutoff. Then, they will act with information in Problem A, but undervalue information in Problem B.

A second possibility is that stated cost may affect the decision strategies used to evaluate information systems. When a system is costless or has low stated cost, an individual may decide that detailed benefits analysis is not warranted. When stated costs are high, an expected value analysis may be considered desirable [Beach and Mitchell, 1978]. Within this cost-benefit framework, stated cost would be viewed as a decision environment characteristic which, in turn, affects *task demand*, i.e., the perceived need to use analytic decision strategies.[3]

Interaction Between Context and Task Effects

The above discussion of context effects predicts they will occur, regardless of the stated cost of information. This analysis assumes that context effects occur because the problem wording affects one's overall perceptions of value in the choice set under consideration. On the other hand, these effects may occur because context changes the way costs are framed [Kahneman and Tversky, 1979; Slovic et al., 1982]. If the latter proposition is true, then context effects will occur only when the stated cost of information is positive. For example, positive stated cost information may be overvalued in the information evaluation setting, and evaluated according to the economic model or undervalued in the other setting. This is consistent with individuals viewing the cost of information as a payment for obtaining a valuable good in the information evaluation context and as a loss in the uncertainty reduction context. At the same time, information with zero stated cost would be evaluated consistently across contexts.

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[1] Yet another possibility is the allocation of data processing costs from a service department to individual units. For discussions of the optimal allocation of such costs, see, for example, Zimmerman [1979] and Demski [1980].

[2] For nonlinear utility functions, the expected value of information would differ. However, for nearly all types of utility functions, perfect information should be preferred to no information. The only exception is that extreme risk preferrers may prefer to act without information in Problem B.

[3] See Waller and Mitchell [1984] for an investigation of the relation between task demand and qualitative aspects of accounting information systems.

METHOD

Experimental Setting

The setting of the experiment is a firm that produces a single product. The firm has two divisions, each headed by a single manager (manager A and manager B; see Appendix A). The firm's output and the payoffs to the managers depend jointly on the actions of the managers and the outcome of a random state of nature. Each manager has a choice of one of two actions and there are two possible states of nature. Both managers are aware of each other's payoffs and preferences. Manager A has the opportunity to utilize an information system that generates perfect information on the state outcome (η^P). Alternatively, he may choose to act without an information system (i.e., "use" the null information system (η^0)).[4] Manager B knows manager A's information system choice.

In a game-theoretic analysis of the problem, manager A must make two decisions. First, he must choose between two subgames, one in which he has private information on the state outcome and the other in which he does not. Once he has chosen a subgame, he must choose an action (if acting without information) or a decision rule, which specifies actions to be taken contingent on state outcomes (if acting with information). It can be shown, depending on the payoff sets of both managers, that manager A's payoff at the Nash equilibrium (NE) point in the private information subgame can be greater than, equal to, or less than that at the NE point in the no information subgame (see Appendix B). That is, private information can have positive, zero, or negative expected value for manager A. This result is in contrast to a single-person or decision-theoretic setting, in which the fineness corollary of Blackwell's Theorem states that the value of a finer information system is always greater than or equal to that of a coarser one [Baiman, 1975]. The result is counterintuitive, but the following example illustrates how the value of information might be negative.

Assume the following scenario: Each manager is responsible for one stage of the production process for a precision tool, with one in charge of the casting department and the other responsible for the machining department. The two actions available to each manager represent high and low levels of effort, while the random parameter represents the quality of the raw materials used in the process. When neither manager has private information, the best strategy for both is to expend a high level of effort. When manager A has private information, he is able to adjust his effort level contingent on the state outcome. At the same time, the payoffs are such that it is no longer optimal for manager B to expend a high effort level. This affects the firm's total output and, in turn, lowers manager A's expected payoff.[5,6]

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[4] Note that a choice task was used here, rather than the rating task commonly used in existing subjective information evaluation research. This was done in order to investigate task effects associated with information system cost presentation, as discussed above.

Experimental Design

In the experiment, CONTEXT was a between-subjects variable with three levels and COST was a within-subjects variable with two levels. COST was manipulated within subjects in order to investigate whether subjects attended to it as a decision cue, as discussed above. CONTEXT was a between-subjects variable, since changes in problem wording in the course of an experiment might lead subjects to (1) view all presentations of the problem as equivalent, inhibiting framing effects, or (2) speculate as to the intentions of the experimenter, causing order effects with no clear theoretical interpretation [Keren and Raaijmakers, 1988]. Additionally, the expected value of information (EV) was a within-subjects variable. Levels of COST were zero and positive (0 and 10 units) in the experimental cases. EV levels were negative, zero, and positive (−10, 0, and +10 units).[7] Each of the six resulting cases was repeated five times before the subject was presented with another case, resulting in a total of 30 experimental trials.

All cases with the same stated cost of information were presented together. Order of presentation with respect to stated cost (ORDER) was treated as a between-subjects variable and counterbalanced. The order of presentation with respect to expected value within each level of stated cost was randomized. Ten subjects were presented with each combination of CONTEXT and ORDER, resulting in a total of 60 subjects in the design (see Figure 1).

Experimental Variables

Dependent Variable. The dependent variable in the experiment is the proportion of times over a set of game trials a subject chooses the private information subgame for a given case. Since "manager A" is the only individual in the experimental scenario able to make such choices, all subjects assumed this role. The role of "manager B" was taken by the computer. The computer was programmed to play its Nash equilibrium strategies in each subgame in order to minimize the possibility that subjects playing non-Nash strategies might confound the results.

Independent Variables: CONTEXT and COST. Two different contexts incorporating state uncertainty were used in the experiment. The first context was an information evaluation problem. The parameters (e.g., payoffs and probabilities) in the second context were exactly the same as in the first, except that the problem of information evaluation was presented as a choice between two production processes. One process allowed the manager to make decisions contingent on the observed state of nature, while the other did not. These two contexts will be

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[5] Note that this example is included for illustrative purposes only. The setting presented to subjects was an abstract one, in order to avoid introducing factors which might confound the hypothesis tests [Swieringa and Weick, 1982].

[6] The payoffs for the experiment were determined without regard to whether they represented optimal contracting arrangements for the managers. While this may limit the representativeness of the experimental setting in some respects, it does not affect the principal objectives of the study, which are to determine the effects of task and context variables on subjects' information system evaluations.

[7] The payoffs for the case with EV of −10 and zero COST are shown in Appendix A (see Figures A1 and A3). Other levels of EV were obtained by changing manager A's payoff for the outcome (a_2, b_2) in State 2. For positive COST cases, ten units were subtracted from all of manager A's payoffs in the private information subgame.

Figure 1
Schematic Diagram of Experiment

			Within-Subjects Variables (Case Characteristics)					
Stated Information Cost:			*Zero*			*Positive*		
Expected Value of Information:			*Negative*	*Zero*	*Positive*	*Negative*	*Zero*	*Positive*
Between-Subjects Variables								
Order	*Context*	*Subjects*						
Zero cost first, then positive cost	Basic Game	1 • • 10						
	Process Choice	11 • • 20						
	Information Evaluation	21 • • 30						
Positive cost first, then zero cost	Basic Game	31 • • 40						
	Process Choice	41 • • 50						
	Information Evaluation	51 • • 60						

referred to as the *information evaluation* and *process choice* contexts. In the first of these contexts, the stated cost of information (COST) was labelled as such. In the second, it was presented as an additional fixed cost associated with the process allowing contingent choices (see Appendix A).

A setting without state uncertainty was also used in the experiment. In this setting, subjects chose a subgame (labelled a "production process") and an action to be taken within the subgame. Payoffs for each outcome in the subgames were the expected values of the outcomes for the settings with state uncertainty. The dependent variable for this setting is the proportion of times over a set of game trials a subject chooses the subgame corresponding to private information in the other settings. This setting will be referred to as the *basic game*.[8]

[8] The term CONTEXT will be used in the remainder of the paper to refer to both the settings with uncertainty and those without. There is no "expected value" of in-

The basic game was incorporated in order to determine whether individuals playing under conditions of certainty would choose optimal strategies, as defined within a Nash solution framework (see Appendix B). The basic game therefore serves as a "baseline" against which the settings with state uncertainty can be compared. If optimal subgame choices are observed in the basic game setting, but non-optimal choices are observed in the settings with state uncertainty, one can infer that the non-optimal choices occurred due to the cognitive simplification mechanisms and/or framing effects discussed earlier. If non-optimal subgame choices occur in all settings, additional work is needed to determine: (1) why the deviations from optimality occurred, and (2) if the deviations occurred for the same reason in the settings with and without state uncertainty.

Independent Variables: EV. The expected value of information (EV) was treated as a within-subjects variable, in order to have a basis for testing differences in choice proportions across different levels. These tests provide an indication whether the subjects perceived that the expected value of private information (in the settings with state uncertainty) or the relation between the Nash equilibrium payoffs for the two subgames (in the basic game setting) differs across cases. Planned comparisons are used to indicate whether these differences (or lack of differences) are affected by context and stated cost.

Since the EV variable has three levels, a set of two orthogonal contrasts can be performed on it. The comparison of primary interest is that between observed values of the dependent variable for positive and negative EV levels. It can be written as:

$$q_3 - q_1 \tag{1}$$

where

q_k = the proportion of times subjects choose to play the private information subgame for cases with EV k, and

$k = 1, 2,$ and 3 denote negative, zero, and positive levels of EV.

For the settings with state uncertainty, this comparison indicates whether subjects perceive the value of information in the positive EV case to be greater than that in the negative EV case, or the same. Interactions between other independent variables and this comparison indicate whether or not these variables have an effect on perceived differences in information value.

The second possible contrast in this set is that between zero EV and the mean of positive and negative EV, or:

$$q_2 - (q_1 + q_3)/2. \tag{2}$$

Given that the value of the first contrast is significantly greater than zero, it gives an indication in the settings with state uncertainty whether the perceived differences between the three levels of information value are equal. If these differences are equal, then the value of the second contrast will not be significantly different from zero. If, however, the difference in choice proportions between zero and positive EV levels is smaller than that between zero and negative EV, the second contrast will be positive. In the remainder of the paper, contrasts of the type specified by equation (1) will be referred to as EV(1) and those of the type specified by equation (2) will be referred to as EV(2).

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formation in the basic game setting, since it is played under conditions of certainty. However, for ease of exposition, the term EV will be used to indicate the difference between payoffs at the Nash equilibrium points in the subgames corresponding to private information and no information in the basic game setting. Also, these subgames will be referred to as "private information" and "no information," even in the basic game setting.

Hypotheses

The basic game setting is used in this study as a baseline against which results in the settings with state uncertainty are compared. Therefore, the hypotheses presented below are all based upon predicted interactions of CONTEXT with COST and EV. The hypotheses are grouped together by interaction term in the following discussion.

CONTEXT×COST. COST should only affect subjects' behavior in the settings with state uncertainty. It should have no effect in the basic game setting.

H_1: The private information subgame choice proportion does not differ across COST levels in the basic game setting, while in the settings with state uncertainty, the choice proportion is greater for zero than for positive COST cases.

CONTEXT×EV. The CONTEXT ×EV interaction is an indicator of whether misperceptions of information value have occurred in one or both settings with state uncertainty. Misperception of information value is indicated if the contrast between negative and positive EV levels (the EV(1) contrast) for a setting with state uncertainty is significantly smaller than that for the basic game. The CONTEXT×EV(1) interaction may take one of two forms, depending on which of the premises regarding the effect of problem wording presented above is true. If information evaluation behavior is affected by problem wording, then only the EV(1) contrast for the information evaluation setting should be smaller than that for the basic game. On the other hand, if the misperception of information value occurs consistently, regardless of problem wording, the EV(1) contrasts for both settings with state uncertainty should both be significantly smaller than for the basic game setting.

H_{2A}: The EV(1) contrast is smaller in the information evaluation setting than in the basic game.

H_{2B}: The EV(1) contrast is smaller in both the process choice and information evaluation settings than in the basic game.

Rejection of the null for either of these hypotheses indicates either overvaluation and/or undervaluation of information occurred. Therefore, if the null of H_{2A} or H_{2B} is rejected, either H_{3A} or H_{3B} will be tested. However, it is predicted, based on the discussion in the theoretical development section, that significant results will only be found for overvaluation.

H_{3A}: The private information subgame choice proportion at the negative (positive) EV level is greater (less) in the information evaluation setting than in the basic game.

H_{3B}: The private information subgame choice proportion at the negative (positive) EV level is greater (less) in both the process choice and information evaluation settings than in the basic game.

Another type of CONTEXT×EV interaction concerns the relation between choice proportions for zero and the other EV levels. It is predicted that subjects in the basic game setting will not exhibit a clear preference for either subgame in the cases representing zero EV levels. This results in an EV(2) contrast which is equal or nearly equal to zero. On the other hand, the subjects in either of the settings with state uncertainty may prefer to act with information when it has zero EV, even though in economic terms, they should be indifferent between information and no information at this point. This behavior results in a positive EV(2) contrast, given the EV(1) contrast is in the predicted direction.

H_4: The EV(2) contrast is not significantly different from zero in the basic game, while it is greater than zero in the settings with state uncertainty.

CONTEXT×COST×EV. COST may affect the perceived differences between positive and negative levels of EV, causing them to be greater for positive than for zero stated cost information, leading to a COST×EV(1) interaction. However, this effect should not occur without a related CONTEXT×COST×EV(1) interaction, since COST should *not* have an effect on perceived differences between levels of EV in the basic game setting.

H_{5A}: The EV(1) contrast will be greater for positive than for zero COST cases in the settings with state uncertainty, but not in the basic game setting.

Alternatively, the COST×EV(1) interaction may differ across state uncertainty contexts. As discussed earlier, subjects may view the cost of information as a loss in the process choice context, but as payment for a valuable good in the information evaluation context. If this occurs, the perceived difference between positive and negative levels of EV will be affected by cost only in the process choice context.

H_{5B}: The EV(1) contrast will be greater for positive than for zero COST cases only in the process choice context.

A CONTEXT×COST×EV(2) interaction may arise as follows: Suppose that subjects *do* act consistent with the expected utility hypothesis when evaluating information at the positive and negative EV levels. Also, they are indifferent as to information choice for zero EV cases with zero COST. However, a cost framing effect occurs at the zero EV level. For positive COST cases, the majority of subjects prefer information in the information evaluation setting and the majority prefer to act without it in the process choice setting (see Figure 2). Such an effect is consistent with a shift in reference point due to framing, as described in prospect theory [Kahneman and Tversky, 1979; Tversky and Kahneman, 1981].[9] In this example, the reference point is the status quo in an uncertainty reduction context, while it is one's position after purchasing the information in the information evaluation context.

H_{6A}: The EV(2) contrast is greater for positive than for zero COST cases in the information evaluation setting.

H_{6B}: The EV(2) contrast is smaller for positive than for zero COST cases in the process choice setting.

Subjects and Procedure

The subjects were students at the University of Texas at Austin. Twenty-one were fourth-year students in the Program in Professional Accounting (PPA), 34 were MBA students, and five were first-year accounting Ph.D. students. Subjects were assigned to experimental groups so that the proportion of each type of student was approximately equal in each group. The experiment was run in a computer laboratory using IBM PCs. There

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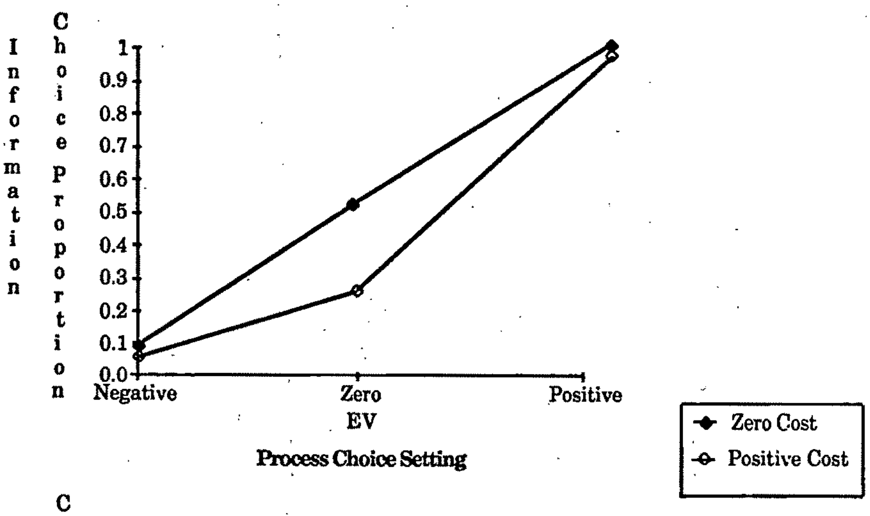
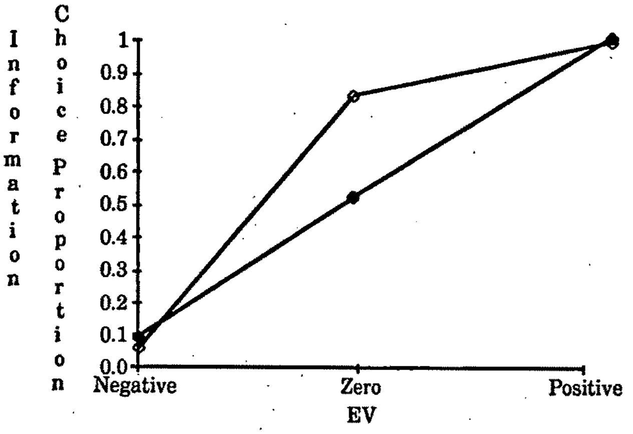
[9] A proof is available from the author.

FIGURE 2
POSSIBLE CONTEXT × COST × EV(2) INTERACTION



Process Choice Setting



Information Evaluation Setting

were six separate experimental sessions, with from six to 16 subjects completing the experiment at any one time. Subjects participating in the same session were randomly assigned to different experimental treatments.

The experiment was conducted in four phases: (1) preliminary instructions, (2) a quiz on the instructions, (3) practice trials, and (4) the main part of the experiment. At the beginning of each experimental session, subjects were given a set of instructions consistent with their experimental condition and assigned to a computer. The computer displayed the game values and expected values (in the settings with state uncertainty) for the practice trials. Subjects were instructed to read the instructions and examine the computer display, but not to proceed with the experiment.

The experimenter then provided additional brief oral instructions on the use of the IBM keyboard and the conduct of the experiment. The subjects were informed they would be paid in cash at the end of the session and reminded they would be eligible for further prizes, based on their performance. They were instructed to ask any necessary questions during the quiz or practice trials, since no questions were allowed during the main part of the experiment. The subjects were then told to finish reading the instructions and proceed with the experiment when ready.

The quiz consisted of questions designed to test subjects' ability to correctly read the payoff matrices. Each subject completed five practice trials with EV of 0 and COST of 5. After the practice trials, the subjects' point endowment was reset to 100 points and they played the 30 actual trials.

During each trial, the computer prompted the subject for two responses: (1) an information (in the information evaluation setting) or process choice (in the basic game and process choice settings), and (2) an action or production plan choice.[10] In the basic game setting, the computer's ("manager B's") action and the payoffs to the subject and computer were revealed after the subject's response. In the other settings, a random number representing the state outcome was drawn and revealed to the subject immediately if he chose to act with information.[11] The computer's action and the payoffs to the subject and computer were then revealed. For cases in which the subject chose to act without information, the computer's action was revealed first, then the random number, and finally the payoffs were revealed. A message on the computer screen notified the subject when payoffs or the stated cost of information were to change on the next trial. After all the experimental trials were completed, the experimenter verified the subjects' point totals and paid them in cash.

Subject payoffs for each trial were stated in points. The conversion rate from points to cash was 1 point = 1 cent. Subjects began the experiment with an initial endowment of 100 points, and accumulated further payoffs on each of the 30 experimental trials. The expected value (or in the basic game setting, the payoff) from making the optimal subgame and action choices for all 30 trials was $16.00. Combined with the initial endowment, this made the expected value for the entire experiment $17.00.[12]

Differences in individual risk preferences were controlled for by designing the experiment so that the *ordinal* relation of the expected values for each strategy combination is maintained under a wide variety of positive monotonic transformations of the matrix values. The results can be affected by risk attitude only in the case in which subjects are extremely risk-averse or risk-seeking. Such risk attitudes are unlikely to occur, given the range of payoffs from the experiment. The payoffs for the experiment were also designed so that the predictions of prospect theory would hold, as long as the general form of subjects' value functions remains consistent with prospect theory (risk-aversion for gains and risk-seeking for losses). Therefore, shifts in the value functions postulated by prospect theory should not cause inconsistencies in subject responses during the experiment.[13]

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[10] The subjects always chose *actions* in the basic game setting and when they were acting without information in the other settings. When they chose to act with information in the settings with state uncertainty, they were told to choose a *production plan*, which is the same as the decision rules discussed in Appendix A.

[11] The random numbers ranged from 1 to 100. Random numbers from 1 to 60 indicated the occurrence of State 1, while numbers from 61 to 100 indicated State 2 had occurred.

[12] Additionally, the top and second place subjects in each CONTEXT treatment group were awarded prizes of $100 and $25.

[13] Proofs are available from the author.

TABLE 1

PROPORTION OF CHOICES—PRIVATE INFORMATION SUBGAME

Panel A. By Cells—Zero Cost:

Order	*Context*	*Negative EV*[1]	*Zero EV*	*Positive EV*
Zero Cost First	Basic Game	0.54	0.80	1.00
	Process Choice	0.50	0.88	0.94
	Information Evaluation	0.80	0.94	0.88
	Mean	0.61	0.87	0.94
Positive Cost First	Basic Game	0.14	0.72	1.00
	Process Choice	0.58	0.82	0.70
	Information Evaluation	0.58	0.76	0.86
	Mean	0.43	0.77	0.85
Mean Values for Contexts	Basic Game	0.34	0.76	1.00
	Process Choice	0.54	0.85	0.82
	Information Evaluation	0.69	0.85	0.87
Overall Mean		0.52	0.82	0.90

By Cells—Positive Cost:

Order	*Context*	*Negative EV*	*Zero EV*	*Positive EV*
Zero Cost First	Basic Game	0.08	0.78	0.94
	Process Choice	0.78	0.68	0.80
	Information Evaluation	0.46	0.66	0.74
	Mean	0.44	0.71	0.83
Positive Cost First	Basic Game	0.32	0.78	0.98
	Process Choice	0.66	0.76	0.70
	Information Evaluation	0.52	0.58	0.76
	Mean	0.50	0.71	0.81
Mean Values for Contexts	Basic Game	0.20	0.78	0.96
	Process Choice	0.72	0.72	0.75
	Information Evaluation	0.49	0.62	0.75
Overall Mean		0.47	0.71	0.82

RESULTS

Main Effects

Table 1 is a summary of the proportions with which the subjects chose the private information subgame, broken down by the four independent variables. Table 2 presents the results of the repeated measures MANOVA of the data.[14,15] The only significant main effects are those for COST ($p=0.004$) and EV ($p<0.001$). The dependent variable proportion for the zero COST level is greater for that for positive COST

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[14] The proportions were transformed before analysis using an arcsin transformation [Neter and Wasserman, 1974, p. 507] in order to avoid the problem of unequal variances across different levels of the dependent variable.

[15] The data meet the compound symmetry assumptions required for a univariate repeated measures ANOVA, however, the multivariate approach was used here to facilitate tests of the interaction hypotheses. With repeated measures MANOVA, the set of orthogonal contrasts on EV is treated as a vector of dependent variables. For each effect involving EV which MANOVA indicates to be significant, separate ANOVAs are done on each individual contrast [Bock, 1975, ch. 7; La Tour and Miniard, 1983]. The multivariate approach is generally less powerful than the univariate. As a check, univariate tests were run on the data. No differences were found between the two approaches as to the significance of main effects or interactions.

TABLE 1—*Continued*

Panel B. Averaged Across COST and EV—Means Across COST Levels:

Order	*Context*	*Negative EV*	*Zero EV*	*Positive EV*
Zero Cost First	Basic Game	0.31	0.79	0.97
	Process Choice	0.64	0.78	0.87
	Information Evaluation	0.63	0.80	0.81
	Mean	0.53	0.79	0.88
Positive Cost First	Basic Game	0.23	0.75	0.99
	Process Choice	0.62	0.79	0.70
	Information Evaluation	0.55	0.67	0.81
	Mean	0.47	0.74	0.83
Mean Values for Contexts	Basic Game	0.27	0.77	0.98
	Process Choice	0.63	0.79	0.79
	Information Evaluation	0.59	0.74	0.81
Overall Mean		0.50	0.76	0.86

Averaged Across COST AND EV—Means Across EV Levels:

Order	*Context*	*Zero Cost*	*Positive Cost*
Zero Cost First	Basic Game	0.78	0.60
	Process Choice	0.77	0.75
	Information Evaluation	0.87	0.62
	Mean	0.81	0.66
Positive Cost First	Basic Game	0.62	0.69
	Process Choice	0.70	0.71
	Information Evaluation	0.73	0.62
	Mean	0.68	0.67
Mean Values for Contexts	Basic Game	0.70	0.65
	Process Choice	0.74	0.73
	Information Evaluation	0.80	0.62
Overall Mean		0.75	0.67

Panel C. Averaged Across All Cases:

Order	*Context*	*Mean Choice Proportion*
Zero Cost First	Basic Game	0.69
	Process Choice	0.76
	Information Evaluation	0.75
	Mean	0.73
Positive Cost First	Basic Game	0.66
	Process Choice	0.70
	Information Evaluation	0.68
	Mean	0.68
Mean Values for Contexts	Basic Game	0.67
	Process Choice	0.73
	Information Evaluation	0.71
Overall Mean		0.71

[1] EV=expected value of information.

TABLE 2
MULTIVARIATE ANALYSIS OF VARIANCE OF PROPORTIONS OF PRIVATE INFORMATION SUBGAME CHOICES

Source of Variation	*Wilks' Lambda*	*F-statistic*	*Probability*
CONTEXT		0.20	0.817
ORDER		0.80	0.375
ORDER × CONTEXT		0.05	0.943
COST		9.06	0.004
CONTEXT × COST		2.95	0.061
ORDER × COST		5.23	0.026
CONTEXT × ORDER × COST		1.34	0.270
EV	0.33	53.05	0.000
EV(1)		106.46	0.000
EV(2)		6.40	0.014
CONTEXT × EV	0.50	10.97	0.000
Context × EV(1)		26.40	0.000
Context × EV(2)		1.11	0.337
ORDER × EV	1.00	0.02	0.982
Order × EV(1)		0.03	0.866
Order × EV(2)		0.01	0.942
CONTEXT × ORDER × EV	0.92	1.16	0.332
Context × Order × EV(1)		1.19	0.312
Context × Order × EV(2)		0.94	0.397
COST × EV	0.98	0.50	0.611
Cost × EV(1)		0.25	0.619
Cost × EV(2)		0.96	0.332
CONTEXT × COST × EV	0.82	2.74	0.033
Context × Cost × EV(1)		3.66	0.032
Context × Cost × EV(2)		3.26	0.046
ORDER × COST × EV	0.95	1.31	0.277
Order × Cost × EV(1)		2.67	0.108
Order × Cost × EV(2)		0.29	0.595
ORDER × CONTEXT × COST × EV	0.82	2.86	0.027
Order × Context × Cost × EV(1)		5.53	0.007
Order × Context × Cost × EV(2)		1.90	0.160

($q_{zero\ COST}=0.75$; $q_{pos.\ COST}=0.67$). The EV(1) contrast is significantly greater than zero ($q_{pos.\ EV}-q_{neg.\ EV}=0.86-0.50=0.36$; $p<0.001$), as is the EV(2) contrast ($q_{zero\ EV}-(q_{neg.\ EV}+q_{pos.\ EV})/2=0.08$; $p=0.014$).

Hypothesized Interactions

The CONTEXT × COST, CONTEXT × EV, and CONTEXT × COST × EV interactions all were statistically significant ($p=0.061$, $p<0.001$, and $p=0.033$, respectively). Table 3 shows the results of tests of individual hypotheses. All these tests were performed using the Dunn-Sidák multiple comparison procedure [Kirk, 1982, pp. 110–111; Games, 1977].

The effect of COST was not significant in the basic game and significant ($p=0.003$) in the information evaluation setting, as predicted by H_1. However, no significant effect was found in the process choice setting, contrary to H_1 (see Figure 3).

TABLE 3
ANALYSIS OF PREDICTED INTERACTION CONTRASTS

Contrast	*t-statistic*	*Probability*
H_1: $(q_{zero\ COST} - q_{pos.\ COST})$ for Each Context		
Context (1)[1]	1.25	0.518
Context (2)[2]	0.32	0.985
Context (3)[3]	3.65	0.003
H_{2A} and H_{2B}: Comparison of EV(1) Contrasts Across Contexts		
Context (1) – Context (2)	6.53	0.000
Context (1) – Context (3)	6.03	0.000
Context (2) – Context (3)	–0.50	0.999
H_{3A} and H_{3B}:		
Comparison of $q_{neg.\ EV}$ Across Contexts		
Context (2) – Context (1)	5.57	0.000
Context (3) – Context (1)	5.18	0.000
Comparison of $q_{pos.\ EV}$ Across Contexts		
Context (2) – Context (1)	–3.25	0.014
Context (3) – Context (1)	–2.97	0.028
H_{5A} and H_{5B}: COST × EV(1) Contrasts for Each Context		
Context (1)	0.97	0.705
Context (2)	–2.49	0.047
Context (3)	0.65	0.889
H_{6A} and H_{6B}: COST × EV(2) Contrasts for Each Context		
Context (1)	1.36	0.449
Context (2)	–2.22	0.087
Context (3)	–0.83	0.795

[1] Context (1) = Basic Game Setting
[2] Context (2) = Process Choice Setting
[3] Context (3) = Information Evaluation Setting

FIGURE 3
CONTEXT × COST INTERACTION

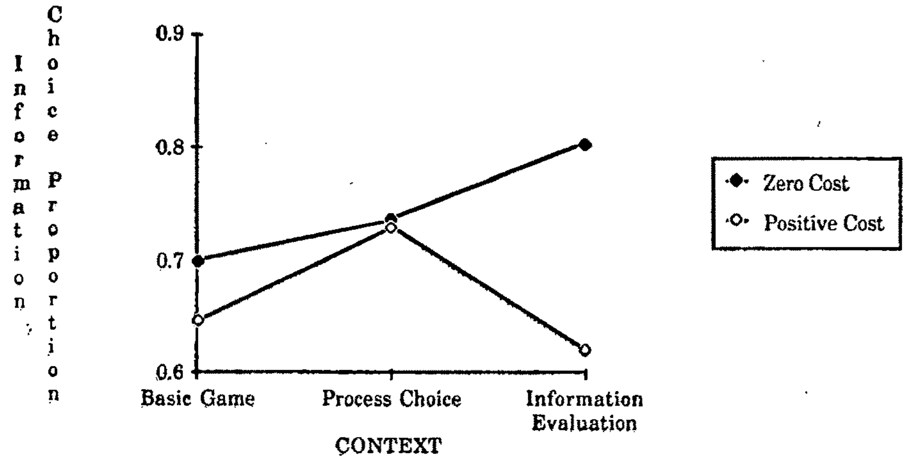
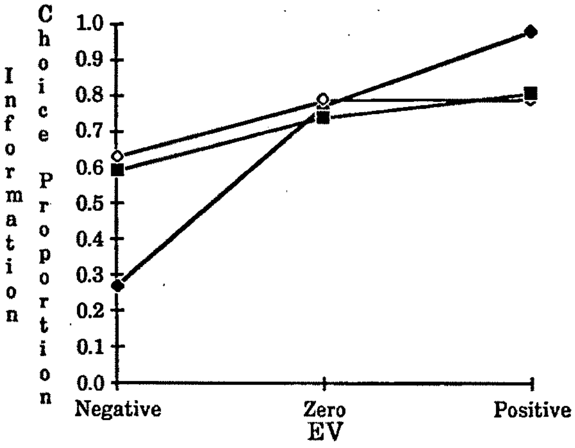


FIGURE 4
CONTEXT×EV INTERACTION



Only the EV(1) component of the CONTEXT×EV interaction is statistically significant ($p<0.001$). Values of the EV(1) contrast are 0.71, 0.16, and 0.22, for the basic game, process choice, and information evaluation settings, respectively (see Figure 4). The absence of a CONTEXT×EV(2) interaction indicates the EV(2) contrast was consistently positive across contexts, including the basic game setting.

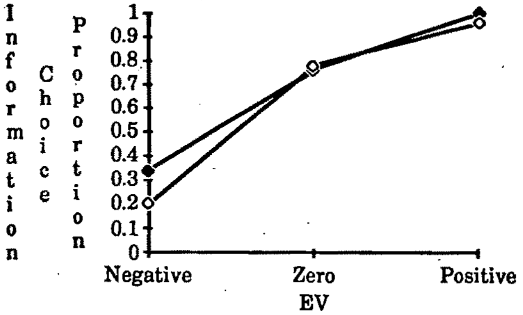
The EV(1) contrasts for both the information evaluation and process choice settings are both significantly smaller than for the basic game setting ($p<0.000$), supporting H_{2B}. In addition, there was no significant difference in EV(1) contrasts between the information evaluation and process choice settings. Tests for overvaluation of negative EV information were significant ($p<0.001$) for both settings with state uncertainty, and tests for undervaluation of positive EV information were significant at $p=0.014$ and $p=0.028$ for the process choice and information evaluation settings, supporting both H_{3A} and H_{3B}. The absolute values of the contrasts for overvaluation tests were larger than for undervaluation tests.

The COST×EV(1) contrast for a given context is computed as the EV(1) contrast for positive stated cost cases minus the EV(1) contrast for zero cost cases. Therefore, H_{5A} and H_{5B} predict positive values for the COST×EV(1) contrast in the settings with state uncertainty. Values of the COST×EV(1) contrasts are 0.10, −0.25, and 0.08 for the basic game, process choice, and information evaluation settings, respectively. Of these, only the contrast for the process choice setting is significantly different from zero ($p=0.047$). However, the contrast is negative. These results support neither H_{5A} nor H_{5B}.

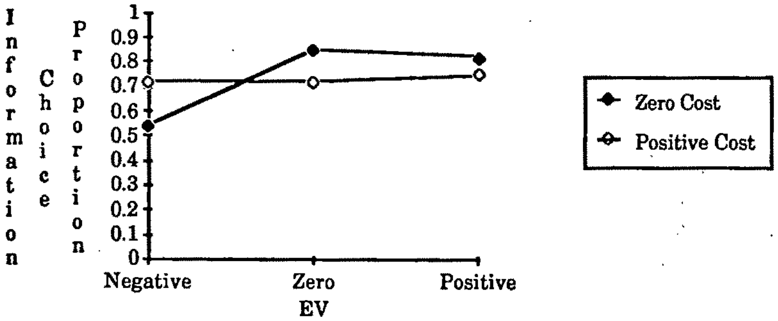
The COST×EV(2) contrasts were computed using a similar formula. They are 0.11, −0.19, and −0.07 for the basic game, process choice, and information evaluation settings. Only the contrast for the process choice setting is significantly different from zero ($p=0.087$). Again, it is opposite the predicted direction and supports neither H_{6A} nor H_{6B}.

Figure 5 shows that COST apparently

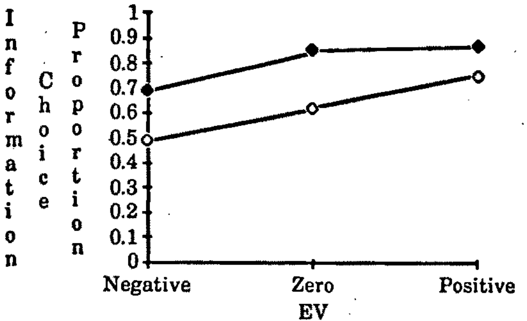
FIGURE 5
COST×EV INTERACTION: BY CONTEXT



Basic Game Setting



Process Choice Setting



Information Evaluation Setting

had a negligible effect on the dependent variable for all levels of EV in the basic game and a consistent effect for all levels of EV in the information evaluation setting. In the process choice setting, choice proportions were nearly equal across EV levels for positive COST cases. For zero COST cases, differences between negative and zero EV levels were observed, but not between zero and positive EV levels.

TABLE 4

TABULATION OF SUBJECT CHOICE PATTERNS BY CONTEXT AND COST

	Basic Game Setting	*Process Choice Setting*	*Information Evaluation Setting*	*Totals*
Zero Stated Cost				
Payoff Maximizing	10	5	4	19
Always Preferring Private Information Subgame	2	8	10	20
Other	8	7	6	21
Positive Stated Cost				
Payoff Maximizing	15	1	3	19
Always Preferring Private Information Subgame	1	12	7	20
Other	4	7	10	21

Interactions with ORDER

In addition to the predicted interactions, two interactions involving the ORDER variable were significant, ORDER×COST ($p=0.026$) and ORDER ×CONTEXT×COST×EV ($p=0.027$). The significant ($p=0.007$) EV(linear) component of the second of these interactions indicates learning effects may have occurred. If learning is taking place, the difference in choice proportions between negative and positive EV cases will be greater in the second half of the experiment than in the first, regardless of ORDER. This leads to an interaction between COST, ORDER, and the linear component of EV.

Further investigation of this interaction showed that the difference in choice proportions between negative and positive EV cases was greater in the second half of the experiment than in the first in the basic game and information evaluation settings, but not in the process choice setting. The difference from the first to the last half of the experiment was statistically significant ($p=0.02$) only in the basic game setting. Inspection of the data for the basic game setting (Table 1) shows that for all cases with positive EV, the observed choice proportion q was at or near 1.0, regardless of COST or the order of case presentation. However, in the zero cost first order, q was 0.54 for negative EV/zero COST cases (those presented first), while q decreased to 0.08 for negative EV/positive COST cases (those presented last). A similar, but weaker, effect occurred in the positive cost first order, where q was 0.32 for negative EV/positive COST cases and 0.14 for negative EV/zero COST cases.

Individual Choice Patterns

An analysis was made of individual choice patterns in order to determine whether they were consistent with the CONTEXT×EV interaction found in the aggregate data. This analysis is broken down by CONTEXT and COST (see Table 4).[16] Payoff maximization was the most common pattern in the basic game setting. On the other hand, consistently acting with information was the most common pattern in the settings with state uncertainty.[17] When behavior across both COST levels is considered, no subjects in the process choice setting consistently acted as expected payoff maximizers throughout the entire experiment, and only one subject did so in the information evaluation setting. In contrast, seven subjects in the basic game consistently made choices consistent with payoff maximization throughout the entire experiment. Additionally, three subjects in settings with state uncertainty consistently acted *without* information—two acted as such only when stated cost was positive and one did so for both levels of stated cost.

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[16] The classifications for each level of cost were defined according to private information subgame choice proportions as follows: payoff maximization—0.2 or 0.0 on the negative EV case, 0.8 or 1.0 on the positive EV case, *and* any proportion on the zero EV case; always preferring information—0.8 or 1.0 on all cases. No meaningful subclassifications could be drawn within the "other" category, except for three subjects who consistently acted *without* information.

To further investigate the CONTEXT × COST × EV interaction, an analysis of individual shifts in choice proportions across COST levels was also made by performing a separate Wilcoxon matched-pairs signed-ranks test for each level of EV within each CONTEXT, using response proportions for each COST level as the dependent variable. None of the comparisons for the basic game or process choice settings were statistically significant. However, the comparisons for all levels of EV within the information evaluation setting were all statistically significant in the expected direction for negative, zero, and positive EV levels ($p=0.04$, $p=0.01$, $p=0.02$).

Action Choice Data

The analysis thus far has focused on subgame choice. Yet, as discussed earlier, one must evaluate the payoff associated with the optimal *action* within each subgame (i.e., evaluate the optimal payoffs for acting with and without information) before choosing a *subgame* (i.e., information system choice) based on that evaluation. It is possible that some of the results presented here occurred because subjects chose the wrong actions in the first phase of the evaluation process. However, dominant actions were chosen 95 percent of the time in the entire experiment, regardless of subgame choice. This result indicates that subjects in the settings with state uncertainty acted consistently with the Nash solution concept concerning *action* choices, even though they appeared to ignore strategic considerations when making *information system* choices.

Slight differences were noted in the proportion of dominant action choices within each CONTEXT (proportions were 0.94, 0.97, and 0.95 for the basic game, process choice, and information evaluation settings), but the differences were not statistically significant. Note also that the proportions of dominant action choices were *lowest* in the basic game setting, even though the highest proportion of optimal subgame choices occurred here.

DISCUSSION AND CONCLUSIONS

Context and Task Effects on Information Evaluation

The choices of subjects in both settings with state uncertainty were relatively unaffected by the expected value of information, compared to the "benchmark" of subjects playing under conditions of certainty. Further analysis of choice data indicated this effect occurred primarily because of overvaluation of information with negative EV in both settings with state uncertainty. Undervaluation of information with positive EV was also indicated, but to a lesser extent than overvaluation. Analysis of individual choice data confirmed that overvaluation of information occurred frequently at the individual level in both settings with state uncertainty, although three individuals demonstrated undervaluation. These findings are consistent with previous subjective information studies in accounting, as well as in other areas [Connolly and Gilani, 1982; Connolly and Serre, 1984]. They are also consistent with empirical observations which indicate that both over- and underacquisition of information routinely occurs in organizations [Feldman and March, 1981].

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[17] The differences across contexts in relative proportions of choice patterns are statistically significant for both zero stated cost ($\chi^2_{(4)}=8.75$; $p=0.07$) and positive stated cost ($\chi^2_{(4)}=29.78$; $p<0.0001$).

The COST task manipulation had no significant effect on behavior in the basic game setting, but did affect behavior in the settings with state uncertainty. These effects differed across the two state uncertainty settings. Within the information evaluation setting, both aggregate and individual analyses showed the effects of COST were in the predicted direction and consistent across EV levels. Consequently, it appears that subjects in this setting attended to COST as a decision cue. In the process choice setting, there was virtually no difference in information choice proportions across EV levels for positive COST cases, while a difference occurred for zero COST cases. At the negative EV level, the choice proportion for positive COST cases was *greater* than that for zero COST.[18] Analysis of within-subjects choice shifts, however, did not indicate that COST had an effect on individual subject decisions in this setting.

The differing effects of COST across contexts indicate that researchers need to consider context and task variables when designing information evaluation experiments, since the results obtained with one set of variables may not be readily generalizable to others. These effects also have potential implications for those who design and implement information systems for use in organizations. The manner in which a given system and the costs associated with it are presented may cause individuals' subjective evaluations of the system to vary.

Decision Strategies for Information System Choice

A number of subjects in the settings with state uncertainty consistently chose to act with information, regardless of the game parameters. This behavior was not affected by learning from the first to the second half of the experiment. These results suggest that subjects in the state uncertainty settings frequently utilized an "act with information" decision strategy.

One possible explanation for the "act with information" strategy is based on the cost-benefit framework [Beach and Mitchell, 1978; Christensen-Szalanski, 1978, 1980] discussed earlier. That is, subjects consciously decided the costs of implementing complex decision strategies outweighed the benefits to be gained from their use [Payne, 1982, p. 383]. A second explanation is that acting with information is a metarule or *metaheuristic*, which is used to generate lower-level strategies [Einhorn, 1980, p. 4]. Kleinmuntz and Thomas [1987] propose that decision makers may use metaheuristics as an alternative to calculative rationality in choosing strategies for specific tasks. They describe the use of an infer-then-act metarule, which is consistent with the use of uncertainty avoidance mechanisms discussed in the second section of the paper. It is not yet known which factors affect the use of metaheuristics. Individuals may have a repertoire of metarules which are automatically called upon when facing certain task situations. Otherwise, their use may be subject to a simplified choice process, in which the input includes decision cues such as context.

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[18] Connolly and Serre [1984] found a similar result, where a significant proportion of subjects presented with decision cues with equal validity but different costs actually chose the cues with the higher cost.

Information Evaluation and Strategic Behavior

As stated in the introduction, a factor which differentiates the present study from previous work is that it was conducted in a multi-person environment, with conflicting individual objectives. An important aspect of the results is that subjects presented with a game with no state uncertainty conformed more closely to the predictions of the Nash model than those playing a game with state uncertainty and equivalent payoffs. This occurred even though controls for differing risk attitudes were incorporated into the experiment.

However, behavior in the basic game setting was not entirely consistent with that predicted by the Nash model. The overall proportion of choices of the "information" subgame in the basic game setting in the "negative EV" case was 0.27, rather than zero. Further analysis of the data indicated learning effects in the basic game, which were not observed in the settings with state uncertainty. The results suggest that in the basic game, subjects may have started out with the belief that their opponent would choose actions at random, rather than in any strategic fashion. Once they were able to observe how their opponent played, they shifted their own strategies to maximize their payoffs, given this new knowledge.

The learning behavior observed in the basic game may have been induced by factors associated with this particular experiment, including: (1) the fact the subjects knew they were playing against a computer, and (2) the wording of the experimental instructions, which emphasized that the subject's opponent makes choices without knowledge of the subject's actions. Either or both of these factors could lead subjects to believe "manager B's" choices occurred at random. An alternative explanation is that inferring predicted actions through experience commonly occurs in strategic settings. This implies a weaker set of behavioral assumptions than those of the Nash solution concept, which presumes that all players are able to simultaneously infer each others' optimal strategies [Bernheim, 1984; Pearce, 1984; and Tan and Werlang, 1986].

The finding that subjects in the settings with state uncertainty were, for the most part, unable to discern the strategic implications of subgame (i.e., information system) choice suggests the presence of uncertainty is an important task variable in competitive settings, from a behavioral point of view. However, exactly how and why uncertainty affected subjects' decisions is not clear. Also, the findings of this study do not indicate that deviations from economic rationality will always occur in competitive settings with state uncertainty. Here, contextual manipulations did not affect the extent to which subjects facing uncertainty acted consistently with an economic model. However, other situations exist in which individuals do use information in a strategic fashion [Ponssard, 1981, pp. 96–100].

Demski and Swieringa [1981] have speculated about the importance of framing in multi-person settings, raising questions about: (1) whether framing and choice processes differ when nature alone and/or choices of other individuals affect the perceived outcomes, and (2) whether behavior in two competitive settings with identical structure, but varying contexts, is dissimilar. The present study has confirmed these speculations to a limited extent, showing that some of the same framing effects and decision strategies that occur in single-person settings also occur in a two-person setting. Additionally, it has shown that the presence of state uncertainty has a significant effect on individual choice behavior.

APPENDIX A

EXCERPTS FROM INSTRUCTIONS TO SUBJECTS

(The instructions below are for the settings with state uncertainty. Places where the wording differs according to context are indicated with brackets, [ ], with the wording for the process choice setting shown first and the information evaluation setting shown second.)

This is an experiment in management decision making. You will play the role of a division manager in a company ("Manager A"). There is one other division manager in the company ("Manager B"). The role of the other manager will be played by the computer. It will be programmed to act as if it were a human subject. You and Manager B will receive payoffs during each period of the experiment. You cannot by yourself control these payoffs. Rather, payoffs to you and Manager B will depend on the actions taken by both of you and on a random outcome.

The payoffs are stated in points. The points are convertible into cash at the end of the experiment at the rate of 100 points = 1 dollar. You will be credited with 100 points, or 1 dollar at the beginning of the experiment and payoffs or losses from each period will be added or subtracted from your account at the end of each period. The experiment will last a large number of periods, so you have the opportunity to earn a significant amount in addition to your initial stake. If your accumulated balance becomes negative at any time, continue to play, as there will likely be enough periods remaining to accumulate a positive balance again.

The sequence of events *during each period* is:

1. You and Manager B will be presented with a display of outcome payoffs and expected payoffs similar to the one currently on the screen.
2. You will choose [a production *process*] [whether or not to obtain information on the random outcome].
3. Manager B will be notified [of your choice of production process] [whether or not you have decided to obtain information].
4. You will choose:
   —a production *action*, if you have chosen [Process X] [to act without information]

   or

   —a production *plan*, if you have chosen [Process Y] [to act with information] and Manager B will choose a production *action*. Manager B will *not* know which production action or plan you have chosen at the time he makes his choice.
5. The computer's random number generator will generate a number between 1 and 100. If the number is from 1 to 60, Outcome 1 has occurred. If the number is from 61 to 100, Outcome 2 has occurred. The random number and outcome

will be revealed to you at this point if you have chosen [Process Y] [to act with information]. Note that Manager B *always* chooses his action without knowledge of the random number or outcome.

6. The following will then be revealed to both you and Manager B:
   a. Manager B's production action. (Your production action is revealed to Manager B at this point.)
   b. The random number and outcome which occurred (if you chose [Process X] [to act without information]).
   c. Your and Manager B's payoffs and losses.
7. Your payoff (loss) for the trial will be added (subtracted) from your accumulated point total . . .

. . . The lower part of the EXPECTED PAYOFFS section shows the expected payoffs for each combination of your *production plan* and Manager B's action choice if you [choose Process Y] [elect to obtain information on the random outcome]. A *production plan* specifies which actions will be taken, depending on the realized outcome. Note that the first two production plans specify that the same action will be taken regardless of the outcome, [just as with Process X] [just as if one were acting without information]. The second two plans allow you to specify actions to be taken *contingent* on the realized outcome. Plan 3 specifies that Action 1 be taken when Outcome 1 occurs and Action 2 be taken when Outcome 2 occurs. Plan 4 specifies that Action 2 be taken when Outcome 1 occurs and Action 1 be taken when Outcome 2 occurs.

At the time Manager B chooses his action, [he *will* know which *process* you have chosen], [he *will* know whether you have chosen to act with or without information], but will *not* know your production action or plan choice or which outcome has occurred. Note that Manager B is always restricted to the choice of a single action regardless of whether you choose [Process X or Process Y] [to act with or without information].

[Process Y] [Information on the random outcome] will have [an additional fixed cost] [a cost] associated with it in certain periods of the experiment, and [not have this additional cost] [be costless] in others. [When there is an additional cost] [When information has a cost and you decide to use it], its cost will be subtracted from the gross payoff for the trial. The [amount of additional cost] [cost of information] is displayed next to the heading ["PROCESS Y"] ["WITH INFORMATION"] on the computer display. This amount has been subtracted from your expected payoff amounts in the [PROCESS Y] [WITH INFORMATION] section . . .

. . . In summary, you must make two decisions during each period: (1) [which production *process* is to be used] [whether you wish to act with or without information on the random outcome] and (2) which production action or plan you wish to carry out. Manager B must choose a production action. Manager B knows all the data regarding payoffs and outcome probabilities displayed on the computer screen at the beginning of each period (i.e., the data currently displayed on the screen). At the time Manager B makes his choice, he *will* know [your process choice] [whether or not you are acting with information]. But he will *not* know your production action or plan. At the end of each period, both you and Manager B will be presented with the following data: (1) the outcome which occurred, (2) the actions taken by both of you, and (3) the payoffs earned by both of you.

FIGURE A1

GAME PARAMETERS

State 1 $p(s_1)=0.6$

	b_1	b_2
a_1	(100, 80)	(100, 20)
a_2	(−25, 70)	(−50, −50)

State 2 $p(s_2)=0.4$

	b_1	b_2
a_1	(−25, 10)	(−60, 80)
a_2	(100, −50)	(−50, 100)

Your payoffs and the [additional fixed cost for Process Y] [cost of information] will generally remain the same from period to period. They will change occasionally, however. The computer will give you a message when the payoffs and/or costs do change. . . .

APPENDIX B

COMPUTATION OF INFORMATION VALUE IN THE EXPERIMENT

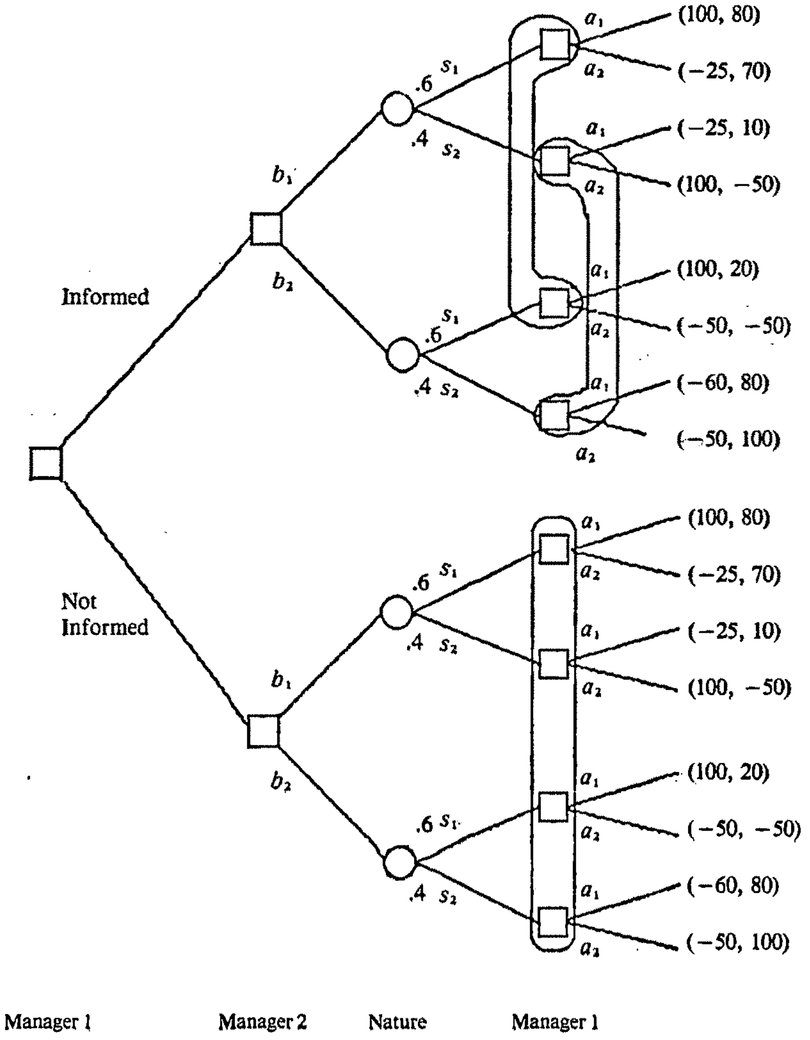
The experimental setting can be characterized as a game of *imperfect*, but *complete* information with an uncertain parameter. *Imperfect* information indicates the players are unable to observe each others' action choices. *Complete* information indicates the players are aware of all the rules of the game, including each others' payoffs and preferences [Schotter and Schwodiauer, 1980]. The game can also be thought of as a reformulation of a game of *incomplete* information, which is a game characterized by uncertainty about one or more game parameters [Harsanyi, 1967, 1968].

In the following discussion, Action 1 is denoted a_1 for Manager A and b_1 for Manager B; Action 2 is denoted a_2 for Manager A and b_2 for Manager B. The two possible states of nature are denoted s_1 and s_2. Figure A2 shows the extensive form of the game facing the two managers, based on the parameters in Figure A1. The game can be decomposed into two *subgames*, labelled "informed" and "not informed" in Figure A2. Manager A's decision problem on his first move is to determine which of the two subgames will yield him a higher payoff.

The game can be more easily analyzed by examination of its strategic form (see Figure A3). Examination of the no information subgame shows that a_1 is a dominant strategy for Manager A, since $50>25$ and $36>-50$. A similar analysis shows that b_1 is a dominant strategy for Manager B. The strategy pair (a_1, b_1) is thus a Nash equilibrium; that is, a pair of strategies such that no player, assuming the other is committed to his strategy, can increase his payoff by unilaterally changing strategies [Shubik, 1982, p. 240].

The strategic form of the private information subgame shows that Manager A has a choice of one of four *decision rules*. For a decision rule a_{ij}, the subscript i indicates Player 1's actions when s_1 occurs; j indicates his actions when s_2 occurs. For example, a_{12} means "choose a_1 when s_1 occurs; choose a_2 when s_2 occurs." The decision rule a_{12}

FIGURE A2
EXTENSIVE FORM OF THE GAME



dominates all of Manager A's other decision rules. Manager B still must choose between one of two *actions* as in the no information case. Manager B's best response to a_{12} is b_2, which makes (a_{12}, b_2) a Nash equilibrium.

The *expected value of private information* to an individual is his or her expected payoff in the private information case, minus his or her expected payoff in the no information case. In the present example, the value of private information to the informed manager is 40−50, or −10. Information also has zero value to the uninformed manager. The negative value of private information for the informed manager is in contrast to a single-person or decision-theoretic setting where the fineness

FIGURE A3

STRATEGIC FORM OF THE GAME

No Information Subgame

	b_1	b_2
a_1	(50, 52)	(36, 44)
a_2	(25, 22)	(−50, 10)

Private Information Subgame

	b_1	b_2
a_{11}	(50, 52)	(36, 44)
a_{12}	(100, 28)	(40, 52)
a_{21}	(−25, 46)	(−54, 2)
a_{22}	(25, 22)	(−50, 10)

corollary of Blackwell's Theorem states that the value of a finer information system is always greater than or equal to that of a coarser one.

This analysis presumes that the game is only played once. In the experiment, the game was played repeatedly over multiple trials. The outcome of a repeated game may differ from that of a single play game under certain circumstances [Luce and Raiffa, 1957]. Specifically, if the Nash equilibrium point in single plays is not Pareto-optimal, the players can achieve gains through cooperation in repeated plays. However, the games used in the experiment were designed so that the single-play optimal solutions were also optimal for both players in repeated plays.

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The Effects of Output Interference, Availability, and Accounting Information on Investors' Predictive Judgments

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ABSTRACT: Prediction is one of the most important aspects of investment decision making. This study provides evidence that investors' predictive earnings judgments can be systematically influenced as a consequence of the combined effects of "output interference" and "availability," and that the use of financial accounting information in the prediction process seems to provide limited benefit in terms of reducing this effect. Output interference is a psychological concept that implies that whatever is thought about first interferes with, and thus inhibits, later thoughts about an issue. An availability-based prediction strategy is one in which the decision maker uses the relative number of pro versus con reasons generated, and/or the ease with which such reasons can be generated, as cues in judging the likelihood of future events. Fifty-eight investors participated in an experiment that demonstrated that the order in which they considered opposing arguments regarding the possibility of reaching a specified level of earnings had an impact on both their ability to generate supporting and opposing reasons and their subsequent probability judgment that earnings would actually reach the specified level. The outcome for which the investors were able to generate the most supporting reasons was judged more probable. Investors were able to think of more reasons supporting a particular outcome, not because there were more such reasons in the objective environment, but rather as a consequence of output interference. The systematic effect on judgment, although perhaps slightly reduced, persisted when investors had access to financial statements while considering the company's earnings prospects.

CONSIDERABLE evidence presented in the judgment and decision-making literature indicates that individuals use heuristic procedures that simplify cognitive processing [Kahneman et al., 1982; Nisbett and Ross, 1980; Slovic et al., 1977; and Tversky and Kahneman, 1974]. In particular, people appear to employ cognitive heuristics when assessing or predicting the likelihood of uncertain events. Although these heuristic procedures are often efficient in that they reduce the complexities of such tasks, an extensive line of research indi-

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cates that they can lead to systematic biases in likelihood judgments [Kahneman et al., 1982; Tversky and Kahneman, 1974].

Accountants have recognized the implications of this line of research for producers (accountants, management, and auditors) and users (investors, creditors, managers, etc.) of financial accounting information [Wright, 1980]. The research reported in this paper focuses on investors, one of the most important financial accounting information user groups.

One important aspect of an investor's task is prediction. Items that often are predicted include future earnings, stock returns, and risk, as well as the many variables which underlie these predictions, such as future general economic conditions, interest rates, oil supplies, and market conditions. The research reported here is designed to help provide an understanding of investors' predictive judgment processes by investigating certain psychological aspects of prediction in this domain. The study examines the effect on investors' predictive judgments of two previously demonstrated and related psychological factors, "output interference" and "availability," and whether and how these factors interact with accounting information. Two main questions are addressed: Can these psychological factors systematically influence predictive judgments in a financial environment? and, Is any such influence reduced by the use of financial accounting information in the prediction process?

This paper begins with some background information about output interference, availability, and the combined effects of these factors on predictive judgment in general. The potential effect on investor judgment of interaction of these factors with accounting information is discussed and hypotheses are developed. An experiment designed to investigate the hypotheses is described in the second section. The third section reports the results of the experiment. The final section provides some explanations for, and implications of, the experimental results.

THEORY AND HYPOTHESES

Output Interference

The notion of output interference implies that whatever people think about first inhibits later thoughts about an issue.[1] Evidence suggests that output interference may inhibit both the retrieval of information from memory [Frederick, 1986; Roediger, 1978; and Rundus, 1973] and the generation of reasons or explanations for the occurrence/nonoccurrence of future events [Hoch, 1984].

Research on memory retrieval processes provided much of the early evidence demonstrating the existence of output interference. Experiments using the part-list cuing procedure (e.g., Slamecka [1968]) demonstrate that when free recall of a list of words is cued by a random subset of words from the list, the probability of recalling any of the remaining words is less than if no cues were provided. Previously retrieved (or experimenter-supplied) items interfered with subjects' ability to recall the remaining items [Roediger, 1978, 1974, and 1973; Roediger et al., 1977; Rundus, 1973; and Smith, 1971]. Raaijmakers and Shiffrin [1981] have developed a general theory of retrieval from long-term memory called "Search of Associative Memory" that predicts this part-list cuing effect in virtually all its variations.

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[1] Output interference refers specifically to recall inhibition and is distinguished from the notion of interference in the learning theory literature where the focus is on whether what is learned in one task is transferred to another task. Such "transfer of training" may facilitate or "interfere" with learning a second task. Moreover, learning a second task may facilitate or interfere with subsequent performance on the first task.

Hoch [1984] hypothesized that a similar output interference mechanism might operate when respondents try to generate reasons or explanations for the occurrence or nonoccurrence of future events. He suggested that as respondents try to generate reasons why future outcomes may occur/not occur, they cannot help but continue to think about the reasons they have already generated; thus, inhibiting the generation of additional reasons. In general, his experimental results supported this hypothesis. Specifically, he demonstrated that subjects were able to generate a first set of reasons (either those supporting occurrence of a future event or those supporting nonoccurrence of a future event, as determined by experimental assignment) in greater quantity and more quickly than a second opposing set of reasons. Hoch demonstrated output interference in reason-generation for several different future events; for example: Would the respondent purchase a video cassette recorder within the next three years? or, Would OPEC impose an oil embargo on the United States in the next five years?

Investigators have recently attempted to determine the contexts and conditions under which output interference can occur. For example, Alba and Chattopadhyay [1985] investigated output interference in a marketing context, and Frederick [1986] in an auditing setting. In his auditing study, Frederick found that both practicing auditors and auditing students experienced output interference when attempting to recall internal controls.

Availability

Tversky and Kahneman [1973] provided much of the early evidence that people sometimes use an availability-based decision strategy when making judgments about the frequency of classes or the likelihood of events. They suggested that with use of this "availability heuristic," likelihood judgments are based on the retrieval from memory of relevant instances or the construction of plausible scenarios. The more instances recalled, or the greater the ease with which one can recall instances or generate plausible explanations for an event, the higher will be the judged probability of occurrence of the event. An availability-based decision strategy is generally useful because frequent events are typically easier to recall and to imagine than infrequent events. Reliance on cognitive availability can lead to deviations from optimal statistical judgment, however, because availability also depends on factors such as saliency and recency that are unrelated to actual environmental frequency [Libby, 1985; Kahneman and Tversky, 1982; and Tversky and Kahneman, 1973]. As discussed below, Hoch [1984] has provided evidence that output interference is another such factor that can influence cognitive availability and, hence, can result in systematic effects on predictive judgment in cases where the availability heuristic is used.

The availability heuristic has been invoked as the explanation for a variety of different experimental findings [Sherman and Corty, 1984; Pollard, 1982]. Of particular relevance to this study are a number of studies that have demonstrated that the act of imagining or explaining a hypothetical future event increases subjects' subjective probability estimates that the event will actually occur [Anderson, 1983; Sherman et al., 1983; Gregory et al., 1982; Sherman et al., 1981; and Carroll, 1978]. For example, Carroll [1978] found that prior to the 1976 Ford-Carter presidential election, subjects who were instructed to imagine that Ford had won judged a Ford victory to be more likely than those instructed to imagine that Carter had won. Similarly, subjects asked to imagine a good college football season capped by a major bowl bid were more likely to predict a major bowl bid than subjects asked to imagine a bad football season. Sherman et al. [1981] found that subjects who explained their hypothetical future success on an upcoming anagram task expected to do better than those who explained hypothetical failure. Such findings have been interpreted as having been the result of subjects' use of the availability heuristic [Carroll, 1978; Gregory et al., 1982; and Sherman et al., 1983]. Sherman et al. [1983] suggest that when people explain a hypothetical event, they access from memory facts and scenarios consistent with the outcome explained, or selectively attend to and encode only information that is consistent with the outcome to be explained. When later judging what is actually likely to happen, subjects rely on the facts and impressions that are most available. The facts and scenarios recently generated during the explanation task will likely come to mind first and serve as the basis for judgment. Apparently, subjects take availability as an indication of likelihood, failing to recognize that the availability is based only on the fact that they were recently induced to access that information [Sherman et al., 1983].

Combined Effects of Output Interference and Availability

Hoch [1984] proposed a conceptual model linking output interference with the use of an availability-based decision/prediction strategy, and demonstrated that this link had important implications for predictive judgments. As noted earlier, he found evidence that previously generated reasons why a future event might/might not occur (i.e., a first set of reasons) interfered with subjects' ability to generate a second, opposing set of reasons. In addition, subjects' probability judgments that the event would actually occur were systematically influenced by whichever side of the issue they thought about first. Thus, Hoch concludes that output interference in reason-generation led to a systematic effect on subjects' predictions of future events. The explanation provided for the effect of output interference in reason-generation on judgment is that subjects used the availability heuristic to judge the likelihood of the future events. Since one set of reasons was more cognitively available (i.e., subjects thought of more such reasons), the future event supported by the more available set of reasons was judged more probable. The differential availability of reasons supporting occurrence versus nonoccurrence was due to output interference in the reason-generation phase of the experiment as opposed to actual circumstances in the objective environment. Thus, in Hoch's model, use of the availability heuristic is the mechanism by which the differential availability of reasons resulting from output interference influences predictive judgments. Although not interpreted as such, similar findings in a recent study by Levi and Pryor [1987] provide support for this model.

Effects of Output Interference and Availability on Investors' Predictive Judgments

The findings described above may have important implications for the many predictive tasks performed by investors. Possible judgmental effects of use of the availability heuristic by investors or others who attempt to predict financial or economic outcomes have been discussed, although infrequently, in the accounting and finance literature [Wright, 1980; Slovic, 1972]. Such potential judgmental effects at the individual investor level need not contradict the concept of an informationally efficient market. Grossman [1976] and Verrecchia [1979] have provided models wherein market efficiency can exist in spite of informationally deficient individual investors or idiosyncratic investor beliefs. On the other hand, new questions about market efficiency have been raised in the finance literature where anomalies such as investor overreaction [DeBondt and Thaler, 1987; 1985] and the disposition to sell winning shares too early or ride losing shares too long [Ferris et al., 1988; Shefrin and Statman, 1985] have been identified.

With regard to Hoch's predictive judgment model linking interference and use of the availability heuristic, investors are likely to generate reasons or scenarios supporting particular future outcomes, such as higher earnings, as a natural part of the prediction process. If initial thoughts about the future outcome interfere with and, thus, inhibit the generation of opposing reasons or scenarios, thoughts supporting a particular outcome may be more cognitively available to an investor at the time of judgment. Thus, if an investor uses cognitive availability as a cue to likelihood assessment, the resulting probability judgment could be influenced toward whichever outcome the investor thought about first. This line of reasoning leads to two hypotheses:

H_1: Investors' initial thoughts about a company's future earnings will interfere with the generation of opposing thoughts, thus resulting in differential availability of supporting and opposing arguments.

H_2: Differential availability of supporting and opposing arguments will affect investors' probability judgments regarding future earnings outcomes.

Effects of Accounting Information on Investors' Predictive Judgments

Both the Securities and Exchange Commission (SEC) and the Financial Accounting Standards Board (FASB) have identified investors as primary users of accounting information and share a concern over the effects of such information on investor welfare [FASB, 1976; SEC, 1977]. Accounting information is often used by investors to assess the prospects of an enterprise [FASB, 1978, par. 42] and, more specifically, accounting information may be used to aid in the prediction of future earnings [FASB, 1978, par. 47]. Beaver [1981] considers accounting earnings from an informational perspective arguing that investors' estimates of future earnings play a prominent role in determining securities prices.

As discussed above, investors' predictions could be influenced by the combined effects of output interference and availability. Whether and how accounting information interacts with these psychological factors to affect investors' predictions is an open empirical question. Nevertheless, as described below, previous research suggests that access to accounting information could potentially lessen the influence of these factors on judgment. Among possible reasons for reduced influence are: (1) the accessibility of accounting information may result in diminished output interference, and (2) using a standardized prediction strategy based on accounting information could largely eliminate the availability issue.

In previous studies of output interference, internal memory search was the only strategy available to subjects as they attempted to retrieve either items from a previously studied list (e.g., Roediger [1978]) or information necessary to generate reasons [Hoch, 1984]. In these studies, output interference resulted in memory retrieval failure. In the present study, accounting information represents an external source of relevant information that could reduce reliance on memory and/or facilitate the generation of opposing arguments, making memory retrieval failure less of a problem. Hence, hypothesis H_3 is as follows:

> H_3: Accessibility of financial statements will result in less output interference than is observed when investor's thoughts depend exclusively on internal memory search.

Despite the potentially facilitating effect of accounting information, we would not expect that such information would entirely eliminate output interference. Investors cannot obtain ready-made arguments or scenarios about future events directly from financial statements. Rather, information must be retrieved from memory and combined with externally available accounting data in order to construct meaningful arguments that support or contradict future outcomes. Thus, previously retrieved or generated information might still interfere with subsequent attempts at retrieval and generation. Also, the observed tendency of subjects to attempt to confirm rather than disconfirm a currently held hypothesis [Mynatt et al., 1977; Wason and Johnson-Laird, 1972], and their reluctance to abandon initial beliefs even in the face of discredited evidence [Ross et al., 1977; Ross et al., 1975] indicates that access to accounting information might not be entirely effective in eliminating output interference.

If accounting information eliminates output interference, there will be no interference-induced differential availability of supporting and opposing arguments at the time of judgment. Consequently, use of the availability heuristic would not be expected to result in systematically influenced judgments. If, on the other hand, output interference persists, the question becomes: Does the resulting differential availability of arguments affect judgment?

There is some evidence that experienced financial information users rely on mental checklists to guide them in financial analysis tasks [Bouwman et al., 1987; Bouwman, 1984]. If investors have developed standard mental routines for predicting future outcomes that include analysis of accounting data, then access to such data might lead investors to make an overall judgment about a future outcome based on the application of consistently applied evaluation rules inherent in their routine. If investors are willing to accept the outcome of this standardized mental routine as the sole basis for their prediction, then their prediction strategy is independent of availability, and the differential availability of arguments would not be expected to influence judgment. While it is unlikely that investors would limit their thinking exclusively to a rigid routine or rely solely on the output of such a routine as the basis for their judgment, we would expect that applying such mental routines would lessen somewhat the impact of availability on judgment. Thus, the final hypothesis is as follows:

> H_4: Accessibility of financial statements will result in a reduced effect of availability on investors' probability judgments regarding levels of earnings.

METHOD

This study applies Hoch's [1984] insights regarding the psychological aspects of prediction to a financial setting. It examines whether output interference, resulting from the order in which arguments are generated, affects the availability of arguments and subsequent predictive judgments. Prior research is extended in two ways. First, the subjects in this study were investors making predictions about a company's earnings. Earnings predictions play a central role in investment analysis [Sharpe, 1985]. Hoch's subjects were students making predictions of future events in which they had no special interest or about which they had no special expertise. Second, in the present study the amount of information provided to subjects was manipulated. Some subjects were provided with only the name of a company, while other subjects were provided with both the name and the financial statements of the company. Subjects given only the company name as a retrieval cue had to rely entirely on internally-generated information to make their predictive judgments. Subjects who had access to financial statements were able to draw on both internally-generated information and information obtained from the financial statements. In Hoch's study all subjects had to rely entirely on information retrieved from memory to make their predictive judgments.

Subjects

Fifty-eight investors, drawn from the membership of seven investment clubs, participated in the experiment. Investment club members were used as subjects for several reasons. First, investment club members may be more interested in understanding stock investment than many other investors, most of whom are willing to let financial specialists make their stock investment choices for them. Second, investment club members have personal funds invested in stocks held by the club. The average subject's share of his or her club's fund at the time of participation in the experiment was approximately $715, with a range from $250 to $900. Third, many investment club members have sizable personal stock investments separate from their share of the club's fund. Seventy-six percent of the subjects indicated they currently have, or have had, such investments. The average personal stock investment of these subjects was approximately $27,000.

Task

The experimental task involved thinking about the earnings prospects of Apple Computer, Inc. and assessing the likelihood that Apple's earnings would increase by at least five percent over the next 12 months. Apple Computer, Inc. was selected as the company to be used in the experiment for several reasons. First, the company had high name recognition. Second, despite the company's high name recognition, a pilot study indicated that subjects did not know specific details contained in the company's recent financial statements. The experiment called for a company familiar enough that subjects could think of reasons why its earnings prospects might be good or bad without having access to financial information, while at the same time not so well-known that providing subjects with financial data would add no new information. None of the 58 subjects had ever owned Apple stock, and only five subjects indicated they had read recent press reports about the company.

The design required that the issue chosen (earnings prospects) be divisible into two possible outcomes. While increase/decrease would seem to be the obvious dichotomy, this division created a problem for subjects who thought earnings would remain the same as the previous year. Thus, subjects considered whether earnings would be at least five percent higher than the previous year, or *not* at least five percent higher. Care was taken to select a percentage that was reasonable and did not lead subjects to an obvious conclusion about the validity of the statement. A large increase in earnings, or a large projected loss, would probably have been judged as unlikely by most subjects. There was no external-to-the-study consensus as to the company's prospects at the time. Both prior to and throughout the data collection period, financial press coverage and available analysts' predictions indicated considerable uncertainty regarding the company's future earnings prospects, providing reasons for both optimism and pessimism.[2]

Design

A 2x2 between-subjects design was used to test for the effects of order of reason generation and amount of external information on subjects' ability to generate reasons and their predictive probability judgments. The first variable, order of generation, had two levels: pro-con (P-C) and con-pro (C-P). In the P-C condition subjects were first asked to list reasons why they thought the earnings of Apple Computer, Inc. *would* increase (pro) by at least five percent, and then to spend the same amount of time listing reasons why they thought the company's earnings *would not* increase (con) by at least five percent. The C-P condition reverses the order.

The information variable also had two levels: name only (NO) and name with data (NwD). In the NO condition subjects were given only the name of the company. NwD subjects were given both the company name and financial statements.[3]

Procedure

The experimental data were collected by attending a regular monthly meeting of each of the seven investment clubs over approximately a one-month period. The average number of members completing data forms at each meeting was nine, with a range from six to 12. Each administration of the experiment involved randomly assigning subjects to one of two cells, i.e., either NO/P-C and NO/C-P, or NwD/P-C and NwD/C-P. All cells contain data from at least three separate administrations of the experiment.

All subjects began the experiment by reading a set of general instructions that briefly described the purpose of the study, explained that the context of the experiment was the actual current economic environment, and described some general procedures for the experiment. More specific instructions described the reasons-listing task that subjects would complete and provided a reasons-listing example. This example did not relate to a company's economic prospects so as not to provide readily available reasons that subjects could merely transfer to the experimental task that they would complete. These instructions also stressed that subjects should list any and all reasons that occurred to them, that their reasons would not be evaluated, and that there was no correct number of reasons. The amount of time allowed to complete the reasons-listing task was indicated and subjects in the NwD conditions were told they could use the financial information provided to them if they so chose.

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[2] See, for example, *Newsweek*, May 27, 1985; *The Wall Street Journal*, June 17, 1985; *Time*, September 30, 1985; *The Wall Street Journal*, September 23, 1985; *The Wall Street Journal*, October 31, 1985; *The Wall Street Journal*, November 5, 1985; and *The Wall Street Journal*, January 17, 1986.

[3] Financial statement data were taken from both the 1985 and 1984 annual reports, and included the following for both years: financial highlights (graphed for five years), selected financial data for five years, and the financial statements and notes. The 1985 information was the most current publicly available financial statement data at the time the experiment was conducted.

Subjects read the instructions described above, were given a brief oral summary of the instructions, and were allowed to ask questions about the task. The anonymity of their participation was stressed to encourage forthright responses.

The reasons-listing portion of the experiment was similar to that used by Hoch [1984]. Subjects were randomly assigned to either the P-C or C-P order condition and instructed to think of reasons why Apple Computer, Inc.'s earnings might (pro) or might not (con) increase by at least five percent. For example, in the P-C order condition subjects were instructed as follows:

> Think about why Apple Computer, Inc.'s earnings for the next 12 months might be at least five percent higher than for the last 12 months. In the space below, write down all the reasons you think Apple Computer, Inc.'s earnings might be at least five percent higher.

Subjects were allowed three minutes to list their reasons. Subjects who were first instructed to list pro reasons were then allowed another three minutes to list con reasons, and vice versa.

Subjects in the NwD information condition were given more time to list their reasons than those in the NO information condition to allow them to review the financial data. NwD subjects spent a total of ten minutes (five for pro plus five for con) generating reasons, while NO subjects spent a total of six minutes.

Immediately after listing their reasons, all subjects made a probability judgment that Apple Computer, Inc.'s earnings for the next 12 months would actually be at least five percent higher. They indicated their judgment on a probability scale which was divided into deciles and had endpoints of zero and one, labeled "absolutely no chance" and "absolutely certain," respectively.

RESULTS

A net reasons value was calculated for each subject by subtracting the number of pro reasons generated from the number of con reasons generated. The average of these individual net reasons values for each data cell, along with the average number of pro reasons and the average number of con reasons, is reported in Table 1, panel A. An average probability judgment value was calculated for each data cell by averaging the individual probability judgments of subjects in that cell (see Table 2, panel A). The results of a separate 2x2 analysis of variance (ANOVA) for each of these dependent variables are reported in panel B of Tables 1 and 2, respectively.

Hypothesis H_1, which predicted output interference is supported. The net reasons values are significantly different for the two order conditions ($F=6.42$, $p<.02$).[4] This indicates that, on average, subjects in the P-C condition were able to think of more pro reasons than con reasons, while subjects in the C-P condition were able to think of more con reasons than pro reasons. These results agree with Hoch's [1984] findings, and suggest that output interference can come into play in the financial decision making of investors.

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[4] All tests reported in this paper for net reasons were also performed using proportion values calculated for each subject as follows:

$$\text{Proportion} = \frac{\text{Number of Pro Reasons}}{\text{Number of Pro Plus Con Reasons}}.$$

Tests using these proportion values yielded the same conclusions as tests using the net reasons values.

TABLE 1
COMPARISON OF NET REASONS GENERATED
($n=58$)

Panel A. Averages:

Information Condition	*Order of Reason Generation* *Pro-Con (P-C)*	*Con-Pro (C-P)*
Name Only (NO)		
Number of pro reasons	4.67	4.08
Number of con reasons	3.50	4.39
Average net reasons	1.17	−.31
	(12)*	(13)
Name with Financial Statement Data (NwD)		
Number of pro reasons	4.47	3.68
Number of con reasons	4.29	4.56
Average net reasons	.18	−.88
	(17)	(16)

Panel B. Analysis of Variance—Net reasons=f(information condition, order of generation, and information ×order interaction):

Factor	F-*statistic*	*Probability*
Information condition	2.44	.124
Order of generation	6.42	.014
Information × order interaction	.18	.673

* Number of subjects are in parentheses.

Hypothesis H_2, which predicted that differential availability of reasons would affect probability judgments, is also supported. Two tests were run to reach this conclusion. First, the ANOVA reported in Table 2 tests the effect of order on judgment. The average probability judgments are significantly different for the two order conditions ($F=5.81, p<.02$).[5] As predicted, subjects in the P-C order condition made, on average, systematically higher probability judgments (55.2 percent and 52.5 percent) than subjects in the C-P condition (42.2 percent and 41.3 percent). But order, *per se*, was not expected to affect judgment. Rather, order was expected to affect the availability of reasons, which in turn was expected to affect judgment. To more directly test this availability hypothesis, an analysis of covariance (ANCOVA) was conducted to test the effect of order on judgment using net reasons

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[5] Because the probability judgments and net reasons values were obtained from the same subjects, a multivariate analysis of variance was run with these values as the dependent measures. The results, which are consistent with the ANOVA's reported in Tables 1 and 2, are as follows:

Factor	F-*Statistic*	*Probability*
Information condition	1.22	.304
Order of generation	4.44	.017
Information × order interaction	.09	.916

TABLE 2
COMPARISON OF PROBABILITY JUDGMENTS
($n=58$)

Panel A. Averages:

Information Condition	*Order of Reason Generation* *Pro-Con (P-C)*	*Con-Pro (C-P)*
Name Only (NO)		
Average probability judgment	55.2	42.2
	(12)*	(13)
Name with Financial Statement Data (NwD)		
Average probability judgment	52.5	41.3
	(17)	(16)

Panel B. Analysis of Variance—Probability judgment = f(information condition, order of generation, and information × order interaction):

Factor	*F-statistic*	*Probability*
Information condition	.13	.720
Order of generation	5.81	.019
Information × order interaction	.03	.869

* Number of subjects are in parentheses.

as a covariate. It was expected that the covariate, net reasons, would be significantly related to judgment, but once this effect was extracted, the effect of order on judgment would no longer be significant. The expected result obtained. The relation between the net reasons covariate and judgment was significant ($F=8.00$, $p<.01$), while the relation between order and judgment was reduced to nonsignificance ($F=2.52$, $p>.11$). This result demonstrates the mediating effect of differential availability of reasons on judgment, thereby providing direct support for hypothesis H_2. These tests of hypothesis H_2 suggest that a systematic judgmental effect can occur in the financial decision making of investors. Because investors' judgments were influenced by whichever side of the issue they thought about first, the influence is sometimes referred to as a "primacy effect."

Hypothesis H_3, which predicted that accessibility to financial statements would reduce output interference, is not supported. The lack of significant interaction ($F=.18$, $p>.67$) between the information and order variables indicates that access to financial statements did not eliminate output interference. Despite the persistence of output interference, there is some indication that it may have been slightly reduced. A direct comparison of the net reasons values in the name only condition indicates a statistically significant difference ($F=6.36$, $p<.025$, one-way ANOVA), while a similar comparison in the name with data condition indicates a statistically insignificant difference ($F=1.86$, $p=.18$, one-way ANOVA).

Given the results for hypotheses H_2 and H_3, we would not expect support for hypothesis H_4. If NwD subjects used an availability-based judgment strategy as suggested by tests of hypothesis H_2, the persistence of interference observed in hypothesis H_3 would be expected to result in the persistence of the judgmental effect. Although a direct comparison of the average probability judgments in the NwD condition (52.5 percent and 41.3 percent) indicates the difference is not highly significant ($F=2.19, p=.15$, one-way ANOVA), the lack of interaction between the information and order variables ($F=.03, p>.86$) indicates a persistent judgmental primacy effect.

DISCUSSION

The hypothesized explanation for the judgmental primacy effect observed in this study was that the investors used an availability-based decision strategy when making their predictive probability judgments. Thus, the relative number of each type of reason subjects were able to generate was expected to correspond with their probability judgments. P-C subjects were able to think of more pro reasons than con reasons (hypothesis H_1) and made higher probability judgments (hypothesis H_2). C-P subjects, on the other hand, were able to think of more con reasons than pro reasons and made lower probability judgments. Moreover, the ANCOVA results described earlier provide direct support for the availability explanation.

The results of the tests of hypotheses H_3 and H_4 which indicate a close correspondence between net reasons values and probability judgments, also provide support for the hypothesized availability explanation of the judgmental effect. For example, in the P-C order condition a reduction in the net reasons variable from 1.17 for NO investors to .18 for NwD investors is associated with a corresponding reduction in their probability judgments from 55.2 percent to 52.5 percent. This pattern held true in the C-P order condition where an unpredicted but slight increase in output interference led to a similarly unpredicted and slight increase in the primacy effect.

Apparently, output interference can play a role in determining what thoughts are cognitively available to investors when they make predictions. Given the uncertain and difficult nature of most investment-related predictions, investors may rely on an availability-based prediction strategy when confronted with such tasks. The consequence seems to be investment predictions that can be influenced by the way investors first think about the issue. Use of financial statements in the prediction process may do little to moderate these effects.

Why would investors rely on a mental "process" cue such as the relative number of pro versus con reasons, rather than relying on the "content" of the specific information which came to mind? Hoch [1984] suggests that the reason people sometimes rely on process cues lies in the nature of the task itself. Interference in reason generation is more likely to influence judgments for novel or difficult questions. Such questions do not facilitate direct memory retrieval but rather require construction of inferences based on the results of memory search. Subjects must search for clues to help answer difficult or ambiguous questions and may rely on availability as a cue to likelihood. For easy or familiar issues, on the other hand, output interference might not influence judgment if the evaluation process has occurred previously and the subject already "knows" the answer.

Do investors "know" the answer or must they "search for clues" when they attempt to predict a company's future earnings? Although investors are familiar with such predictions, earnings prediction is a difficult and uncertain task. Hoch [1984] distinguishes prediction tasks from other types of tasks for which there may be a well-developed question-answering routine. As an example of the latter, he notes that even though he does not know how many radios he owns, he knows how to figure it out. He need simply imagine himself walking through each room of his house tallying the number as he "sees" them. Investors can have no such well-developed answering routine which yields the "true" answer because at the time of judgment the true answer cannot be known by definition. Of course, investors have at their disposal certain prediction aids, e.g., probabilistic economic forecasting, econometric modeling, and traditional financial statement analysis, but none of these techniques guarantees a correct prediction. So investors are left to make earnings predictions based on whatever cues are available at the time of judgment. One such cue is a sense of the relative number of arguments supporting or contradicting a particular future outcome. If this sense is based on a set of cognitively-constrained available arguments, it can be an inappropriate cue for prediction. This does not suggest that the resulting predictive judgments are random or haphazard. On the contrary, the results of this study suggest that investors' judgments may be quite systematic and, consequently, perhaps even predictable.

The results described in this study raise the question of what effect, if any, the systematically influenced predictive judgments of individual investors could have on the market prices of the related stock. If order effects occur randomly in the investing population, any resulting effects on the predictive judgments of the investors should also be random. Consequently, some investors might be influenced toward overpricing the stock while others might be influenced toward underpricing the stock. Hence, there should be no effect on the price of the stock. If, on the other hand, there are environmental factors, e.g., sensational news items or disproportionate news coverage, that cause most investors to begin thinking about a company's prospects from a similar perspective, the tendency to overprice or underprice the stock as a consequence of the investors' individual predictive judgments might not be random. Lichtenstein et al. [1978] and Combs and Slovic [1979] have shown that biased media exposure (i.e., cases for which the frequency of coverage and amount of space assigned are disproportionate relative to true frequencies) can result in biased judgments of the frequency of certain causes of death. If investors' judgments about a company's future prospects are similarly affected by disproportionate media exposure or other sensational, exaggerated, or even spurious, environmental factors, the potential for price overreaction to such factors seems quite real. Camerer [1987] has demonstrated that some cognitive biases persist in experimental market settings.

There are several possible ways to potentially reduce the judgmental influence reported in this study. This goal would become more important if additional research indicated that more sophisticated investors and analysts were prone to similar effects. Presently, the effects on predictive judgment of high levels of investment expertise are unknown. Nevertheless, in a related study, Anderson and Wright [1988] have provided evidence that auditing expertise may eliminate the "explanation effect," whereby explaining an outcome increases subjects' judgments that that outcome will actually occur. Higher levels of investment expertise could similarly reduce the judgmental effect reported in this study. Another way to potentially reduce the judgmental effect may be to train investors to better understand financial statements and/or induce them to rely more heavily on the financial information available to them. However, given that the judgmental effects reported in this study are cognitive in nature, and possibly inherent in prediction tasks, it isn't clear that they could ever be fully eliminated.

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Estimating the Marginal Cost of Operating a Service Department when Reciprocal Services Exist

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ABSTRACT: Prior work has examined models in which the reciprocal cost allocation method yields allocation rates that are equal to the marginal costs of operating service departments. We extend this work by analyzing more general production functions for service departments and by incorporating uncertainty. The results demonstrate that the allocation rates derived from the reciprocal cost allocation method are random variables that, in general, are not equal to the expected marginal costs of operating the service departments. In particular, the reciprocal cost allocation rates are biased estimates of these expected marginal costs if any of the service departments operate at a point on their production functions at which the marginal physical product is not equal to the average physical product of their inputs. We also analyze three econometric procedures that provide consistent estimates of the marginal costs. The simulation results indicate that the standard deviations of these estimators are considerably larger than those of the reciprocal cost allocation rates. Because the estimates of the marginal costs provided by the reciprocal cost allocation method have a greater degree of bias, but a lower standard deviation than the estimates provided by the other methods, none of the methods provide estimators that are unambiguously best. Factors that affect the magnitudes of the bias and relative efficiency of the reciprocal cost allocation rates are also discussed.

THIS paper examines the estimation of the marginal cost of operating service departments when they provide services to each other, as well as to the production departments.[1] An important result was provided by Kaplan [1973], who constructed an economic model of the firm in which the allocation rate derived using the reciprocal cost allocation method is equal to the marginal cost of providing a unit of service to the production departments, after taking account of all the interdependencies among the service departments.[2] In this paper, the economic model considered by Kaplan [1973] is generalized by integrating two important features. First, we allow for a more general production

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[1] This information would be useful, for example, in deciding whether it would be less costly to provide an additional unit of service internally or to acquire the service externally. Moreover, if a firm is deciding how to

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function for the service departments. Second, we explicitly incorporate uncertainty into the model. In this expanded setting, the allocation rates derived from applying the reciprocal cost allocation method are no longer equal to the expected marginal costs of operating the service departments. Instead, the reciprocal cost allocation rates are random variables that can be viewed as providing *estimates* of these expected marginal costs.

The analysis demonstrates that the reciprocal cost allocation rates are *biased* estimates of these expected marginal costs if any of the service departments operate at a point on their production functions at which the marginal physical product is not equal to the average physical product of their inputs. This inequality will exist, in general, whenever the service department production functions are nonlinear, even if they can be perfectly approximated by linear functions over the operating range of output of the service departments. We also analyze three econometric procedures which provide consistent estimates of the marginal costs of operating the service departments. We use simulation techniques to compare the performances of these econometric techniques with the performance of the reciprocal cost allocation rates in estimating the expected marginal costs, and find that the standard deviations of the reciprocal cost allocation rates are considerably *lower* than the standard deviations of the alternative estimators. Because the estimates of the marginal costs provided by the reciprocal cost allocation method have a greater degree of bias, but a lower standard deviation than the estimates provided by the other methods, none of the methods provide estimators that are unambiguously best. The factors that affect the magnitudes of the bias and relative efficiency of the reciprocal cost allocation rates are also discussed.

The remainder of this paper is organized into five sections. Section I develops the model of the firm's production and cost functions. These functions jointly determine the marginal costs of operating the service departments. Section II discusses the reciprocal cost allocation method, and demonstrates that it can lead to biased estimates of the expected marginal costs of operating the service departments. In Section III, we discuss three alternative econometric methods which provide consistent estimates of the marginal costs. The performance of the reciprocal cost allocation rates is compared to the performances of these alternative procedures using simulation techniques in Section IV, and the study is summarized in Section V.

I. MODEL

In developing a model of the firm's production and cost functions, the parameters of interest are assumed to be the marginal costs of operating the service departments. These parameters are assumed to be fixed, but unknown. For convenience, consider a firm with a single production department, labeled "*p*," and two service departments, labeled "one" and "two."[3] Following Kaplan

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allocate resources among product lines, it is desirable to obtain information about the relative profitability of the product lines. One aspect of calculating the profitability of a product is to estimate the marginal cost of its usage of the service departments' outputs.

[2] Capettini and Salamon [1977] and Chen [1983] provide additional analysis of this issue.

[3] The analysis is easily extended to any number of production departments. In this case, Q_{ip} can be interpreted as representing the total quantity of service provided from service department *i* to *all* of the production depart-

[1973], the economic model of the firm is assumed to be represented by three sets of linear equations. Unlike Kaplan's model, however, we allow the equations to be stochastic, with w_i, u_i, and v_i denoting the disturbance terms in the equations.

$$Q_{ip}=f_{ip}+b_{ip}Q_p+w_i, \quad i=1,2 \qquad (1)$$

$$Q_{ij}=f_{ij}+b_{ij}Q_j+u_i, \quad i=1,2, \text{ and } j=1,2\ (i\neq j) \qquad (2)$$

$$C_i=\alpha_i+\beta_iQ_i+v_i, \quad i=1,2 \qquad (3)$$

The service departments are assumed to provide inputs that the production department uses in order to produce its output. Equation (1) expresses the relation between the input quantity supplied by service department i to the production department, denoted Q_{ip}, as a function of the production department output, Q_p. As discussed in more detail below, equation (1) does not play an important role in our analysis, and it is included mainly for completeness.

The most important feature of the model is that each service department requires some inputs from the other service department in order to function. Equation (2) captures this interaction, in which Q_{ij} is the number of units transferred from service department i to service department j. The parameter b_{ij} is the number of *additional* units that department i must transfer to department j in order for j to provide an additional unit of service. For convenience, we assume that the service departments do not consume their own services, so that $f_{ii}=b_{ii}=0$. Therefore, the total amount of service that department i supplies, Q_i, is equal to $Q_{ip}+Q_{ij}$ $(i\neq j)$. Finally, equation (3) represents the traceable (or direct) cost function of each service department, C_i.

Interpretation of the Intercepts (f_{ij})

One important difference between the present system of equations and that in Kaplan [1973] is that our equations allow for the possibility of nonzero intercepts. These intercepts arise because we assume that the production functions and traceable cost functions are nonlinear when viewed over wide ranges of output. Equations (1) through (3) are assumed to represent linear approximations to the underlying nonlinear functions. It is well recognized in the accounting literature that these linear approximations are only useful when attention is confined to a given operating range of output for the departments (i.e., the "relevant range").[4] Since the zero output level is typically not considered to be in the relevant range, the intercepts are not viewed as representing "fixed quantities" or "fixed costs" (see Horngren and Foster [1987, pp. 769–770] for additional discussion).

The inclusion of nonzero intercepts in the inter-service department production functions (i.e., the parameters f_{ij} in eq. (2)) plays an especially critical role. To interpret the intercept in this equation, consider the shape of a "textbook" pro-

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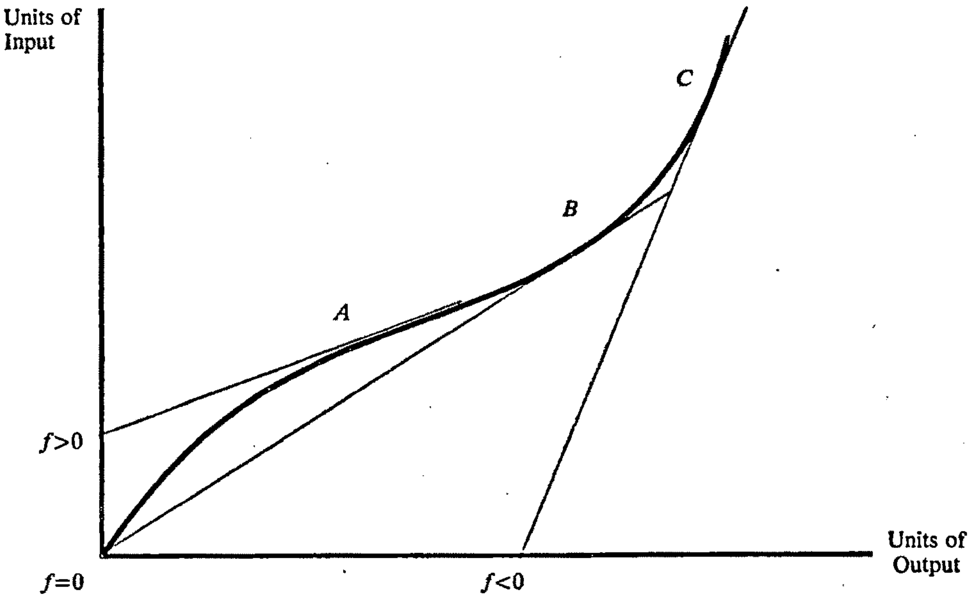
ments. As equation (5c) indicates, the marginal cost of operating the service departments depends only on the traceable cost functions of the service departments and on the interaction among the service departments, and does not depend on the number of production departments. Therefore, the parameter M_i can be interpreted as the expected marginal cost of providing a unit of service from department i to *any* production department.

[4] The use of linear approximations makes the analytics and the estimation much easier. In particular, nonlinear estimation procedures are beyond the scope of this paper. The use of linear functions also allows us to more easily relate the analysis to the prior literature which uses linear functions. In fact, many of the established procedures in cost accounting (e.g., cost-volume-profit analysis, flexible budgeting, and variance analysis) are based on the use of linear approximations to nonlinear production functions and cost functions.

FIGURE 1

STRAIGHT-LINE APPROXIMATION TO A NONLINEAR PRODUCTION FUNCTION

Inputs $= f + b \times$ Outputs



duction function (see Henderson and Quandt [1980, p. 67]), which expresses a department's output as a function of the quantity of its inputs. The slope of the production function at any point represents the marginal physical product of the inputs to the production process. Since we are interested in analyzing the number of additional inputs that the service departments will require in order to produce an additional unit of output, we reverse the axes representing the inputs and outputs, as illustrated in Figure 1. Equation (2) represents the tangent line to the inter-service department production function depicted in Figure 1. The slope coefficient b_{ij} is the *inverse* of the marginal physical product of the inputs from one service department to another. When the tangent line is extrapolated back to the zero-output level, it is easy to see that the intercept can be nonzero. In fact, the intercept would be zero only if the service department is operating at a level at which the marginal physical product equals the average physical product of its inputs, which will occur only by coincidence.[5]

Interpretation of the Disturbance Terms

Another important difference between the present model and Kaplan's is the assumption that equations (1) through (3) are perturbed by additive disturbance terms that have an expected value equal to zero. The disturbance terms could represent the effects of random fluctuations in prices, quality, and/or efficiencies in the purchase and usage of inputs. For convenience, assume that the disturbance terms w_i, u_i, and v_i are independently distributed.[6] Moreover, assume that the disturbance terms u_i and v_i are independent of the variables Q_{ip}, and that the disturbance terms v_i are independent of the total quantities produced by the service departments (Q_i). These restrictions will simplify the estimation of the parameters of the system of equations.[7] As discussed further in Section III, the simultaneous nature of the inter-service department production functions will cause the disturbance terms u_i to be positively correlated with the quantities of service Q_j in equation (2). Therefore, we do not assume that u_i and Q_j are independent.

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[5] For example, in a Cobb-Douglas production function, the marginal physical product is strictly less than the average physical product at all ranges of the production function (except at zero output). In this case, the intercept in Figure 1, which corresponds to the parameter f_{ij}, would always be negative.

Calculation of the Marginal Cost of Operating the Service Departments

Following Kaplan, one can substitute $Q_i - Q_{ip}$ for Q_{ij} in equation (2) and then solve the set of simultaneous equations given by equation (2) to determine the total quantity of service that each service department must supply in order to provide Q_{ip} units of service to the production department. We can then substitute these quantities into the traceable cost equations to determine the total cost of operating the service departments. These calculations yield:

$$C_i = \alpha_i + \beta_i \frac{1}{1 - b_{ij} b_{ji}} \{f_{ij} + Q_{ip} + u_i + b_{ij}(f_{ji} + Q_{jp} + u_j)\} + v_i \qquad (4)$$

The total cost of operating the service departments is therefore:

$$C_1 + C_2 = A + M_1 Q_{1p} + M_2 Q_{2p} + e \qquad (5)$$

where

$$A = \alpha_1 + \alpha_2 + M_1 f_{12} + M_2 f_{21}, \qquad (5a)$$

$$e = M_1 u_1 + M_2 u_2 + v_1 + v_2, \text{ and} \qquad (5b)$$

$$M_i = \frac{\beta_i + \beta_j b_{ji}}{1 - b_{ij} b_{ji}}$$

$$i = 1,2, \text{ and } j = 1,2 \ (i \neq j) \qquad (5c)$$

The parameter M_i represents the expected marginal cost of supplying a unit of service from department i to the production department. Note that M_i depends on two factors: (1) the additional quantity of inputs that must be supplied by *both* service departments in order for department i to provide the unit of service to the production department, and (2) the additional cost of obtaining these inputs.[8] The intercepts in the inter-service department production functions and the traceable cost functions affect the "fixed cost" component of the total cost function, but not the marginal cost terms. In addition, note that the parameters of equation (1) (i.e., f_{ip} and b_{ip}) do not affect either the intercept or the slopes of the total cost function. This occurs because the variable of interest is the expected marginal cost of supplying a unit of service to the production department, not the marginal cost of producing a unit of output from the production department. Therefore, the variables Q_p, Q_{1p}, and Q_{2p} can be viewed as exogenous variables to the system of equations of interest.

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[6] Although this simple structure is sufficient to highlight some of the important issues that arise when uncertainty is incorporated into the analysis, it does not consider the effect of nonzero correlations among the disturbance terms. For example, a positive correlation between the variables w_1 and u_1 might arise if the quality of department one's output affects its usage by both department two and the production department. In addition, if the quality of department one's output is positively related to the price that department one pays for its inputs, one might expect a negative correlation between department one's traceable costs (v_1) and the usage of department one's output (u_1 and w_1).

[7] If the underlying production functions and traceable cost functions are nonlinear, the use of linear approximations may induce a correlation between the independent variables and the disturbance terms of equations (1) through (3). We assume that confining attention to the "relevant range," the misspecification in the linear approximations due to this correlation is of second-order importance, and it is ignored.

[8] Since the production functions and the cost functions are assumed to be linear over the range of operation, the parameters M_i are given by the *same formulas* as the marginal cost numbers derived in Kaplan's [1973] model. This verifies that Kaplan's model is a special case of the present model and facilitates comparison of results.

II. RECIPROCAL COST ALLOCATION METHOD

Prior research (e.g., Kaplan [1973]) has analyzed economic settings in which the reciprocal cost allocation method generates cost allocation rates that are equal to the marginal costs of operating the service departments. This section examines whether the reciprocal cost allocation rates continue to possess this property in our more general setting. The reciprocal cost allocation method allocates the service department costs in proportion to the percentage of service that one department provides to another. To allow for the possibility that the reciprocal cost allocation method may be applied to only a portion of the traceable costs (e.g., the traceable variable costs), let T_i be the traceable costs associated with department i that are to be allocated. Let R_i be the "recycled costs" of department i after the allocation process has been completed.

Under the reciprocal cost allocation method, the recycled costs of department i are allocated to the other departments in proportion to the amount of i's service that they consume. Since department i provides a total of Q_i units of service, the reciprocal cost allocation method can be interpreted as allocating department i's recycled costs at the rate of R_i/Q_i per unit of service. The allocation rate used to charge for the usage of department i's service is:

$$\frac{R_i}{Q_i}=\frac{\dfrac{T_i}{Q_i}+\dfrac{Q_{ji}}{Q_i}\,\dfrac{T_j}{Q_j}}{1-\dfrac{Q_{ij}}{Q_j}\,\dfrac{Q_{ji}}{Q_i}} \tag{6}$$

It is well-known that if the *total* (i.e., variable plus fixed) traceable costs of the service departments are used in the reciprocal cost allocation formulas, the procedure will produce allocation rates that include a "fixed cost per unit." As a result, the allocation rates will generally overstate the marginal costs of operating the service departments. Following Kaplan [1973], we therefore restrict the application of the reciprocal cost allocation method to the traceable *variable* costs of the service departments. If department i provides a total of Q_i units of service, its traceable variable cost is $\hat{\beta}_i Q_i$, where $\hat{\beta}_i$ is an estimate of the parameter β_i derived from an econometric method to be specified later.

Substituting $\hat{\beta}_i Q_i$ for T_i in equation (6) yields:

$$\frac{R_i}{Q_i}=\frac{\hat{\beta}_i+\dfrac{Q_{ji}}{Q_i}\hat{\beta}_j}{1-\dfrac{Q_{ij}}{Q_j}\,\dfrac{Q_{ji}}{Q_i}}. \tag{7}$$

Equation (7) indicates that the allocation rate depends on the terms Q_{12}/Q_2 and Q_{21}/Q_1. Using equation (2), these terms can be expressed as

$$\begin{aligned}\frac{Q_{ij}}{Q_j}&=\frac{f_{ij}+b_{ij}Q_j+u_i}{Q_j}\\&=b_{ij}+\frac{f_{ij}+u_i}{Q_j}.\end{aligned} \tag{8}$$

Proposition 1: The allocation rates generated by the reciprocal cost allocation method are equal to the marginal costs of operating the service departments if and only if all of the intercepts for the inter-service department production functions equal zero (i.e., $f_{ij}=0$), and there is no uncertainty (i.e., $u_i=0$ and $\hat{\beta}_i=\beta_i$).

Proof of Proposition 1: Substituting equation (8) into equation (7) allows expression of the reciprocal cost allocation rates as:

$$\frac{R_i}{Q_i}=\left\{\hat{\beta}_i+\hat{\beta}_j\left[b_{ji}+\frac{f_{ji}+u_j}{Q_i}\right]\right\}\Bigg/\left\{1-\left[b_{ij}+\frac{f_{ij}+u_i}{Q_j}\right]\left[b_{ji}+\frac{f_{ji}+u_j}{Q_i}\right]\right\}. \qquad (9)$$

The proposition follows directly from comparing the allocation rates in equation (9) with the marginal costs in equation (5c).

Q.E.D.

This proposition demonstrates that, in general, the reciprocal cost allocation rates are not equal to the marginal costs of operating the service departments. In fact, the only conditions under which equation (9) and equation (5c) are equal are the conditions assumed in Kaplan's [1973] model. If Kaplan's model is generalized in any way, the reciprocal cost allocation rates are not equal to the marginal costs of operating the service departments. It is also instructive to note that if *any* of the $f_{ij}\neq 0$ (or $u_i\neq 0$), *all* of the reciprocal cost allocation rates are affected.

Effect of the Intercepts (f_{ij}) on the Reciprocal Cost Allocation Rates

In order to concentrate on the effect of the f_{ij} terms, assume for the moment that there is no uncertainty in the model (i.e., $w_i=u_i=v_i=0$, and $\hat{\beta}_i=\beta_i$). Under these conditions, the difference between the reciprocal cost allocation rates given by equation (9) and the marginal costs given by equation (5c) arises because the marginal cost formulas are based on the inverse of the *marginal* physical product of the inputs of the service departments (i.e., b_{ij}), whereas the reciprocal cost method implicitly calculates the inverse of the *average* physical product (i.e., $b_{ij}+f_{ij}/Q_j$). Whenever the inter-service department production functions are nonlinear over wide ranges of output, even if they can be perfectly described by linear functions over the relevant range of output for the departments, the marginal physical product will not equal the average physical product. As a result, the parameters f_{ij} will not all be equal to zero, and the reciprocal cost allocation rates will not, in general, equal the marginal costs of operating the service departments.

To illustrate the effects of the parameters f_{ij}, suppose that $b_{12}=b_{21}=.5$ and $\beta_1=\beta_2=\$10$. Given these parameters, equation (5c) implies that the marginal costs of operating the service departments are $M_1=M_2=\$20$. Assume that the inputs required by the production department are $Q_{1p}=Q_{2p}=3000$. In order to supply this amount of service to the production department, suppose that the service departments must operate at a level where the marginal physical product exceeds the average physical product of their inputs (e.g., at Point A on Figure 1). In this case, the intercepts for equation (2) will be positive. For example, if the intercepts are $f_{12}=f_{21}=1500$, equation (9) implies that the reciprocal cost allocation rate for each department is equal to \$30, which is greater than the true marginal cost of operating the service departments (i.e., \$20).

On the other hand, if the service departments are operating at a level such as Point C in Figure 1, the marginal physical product is less than the average physical product (i.e., the production function has reached a point of diminishing marginal returns), and the intercepts of equation (2) will be negative. For example, given the parameters above, if $f_{12} = f_{21} = -250$, the reciprocal cost allocation rates will equal \$18.33. In this case, the reciprocal cost allocation rates will underestimate the marginal costs of operating the service departments.

It is important to recognize that the parameters f_{ij} are unrelated to the fixed components of the service departments' traceable cost functions (i.e., α_i). In particular, there is no way to infer the magnitude of f_{ij} by examining the relation between costs and quantities *within* a service department. Therefore, the terms f_{ij} will affect the computed allocation rates even if the reciprocal cost allocation procedure is applied only to the traceable variable costs of the service departments.

Effect of the Disturbance Terms (u_i) on the Reciprocal Allocation Rates

Proposition 1 also indicates that the reciprocal cost allocation rates are affected by the disturbance terms in equations (2) and (3). As a result, the reciprocal allocation rates will be random variables that will not always equal the expected marginal costs of operating the service departments, even if all of the $f_{ij} = 0$. The disturbance terms v_i will only affect the estimates of the traceable variable costs per unit of service ($\hat{\beta}_i$). Since the estimates $\hat{\beta}_i$ appear only in the numerator of equation (9), they are unlikely to cause the reciprocal cost allocation rates to be biased estimates of the expected marginal costs. However, the disturbance terms in the inter-service department production functions (u_i) will affect the percentages of service supplied from one department to the other. Since these percentages appear in both the numerator and the denominator of the reciprocal allocation formula, it is possible that these disturbance terms will have a nonzero effect on the expected values of the allocation rates.

The disturbance terms in the denominators of the reciprocal cost allocation rates make it difficult to analytically derive the expected value of these allocation rates. However, an approximate expression for the expected value of the reciprocal cost allocation rates can be derived by constructing a Taylor series expansion of the estimators. In order to concentrate on the effect of the u_i disturbance terms, assume that there are no other sources of disturbance terms in the model and that the intercepts in the inter-service department production functions are equal to zero. Under these conditions, one can show that the reciprocal cost allocation rates are "approximately" unbiased estimates of the expected marginal costs (the proof is in the Appendix):

Proposition 2: Assume that $w_i = v_i = 0$ and $f_{ij} = 0$, and let the reciprocal cost allocation rate for department i be denoted $\hat{M}_i(u_1, u_2)$. Then a Taylor series approximation to $\hat{M}_i$ is an unbiased estimator of the parameter M_i. Specifically, expanding $\hat{M}_i$ to two terms about the means of u_1 and u_2 implies:

$$E(\hat{M}_i) \approx M_i + \frac{1}{2}\left[\frac{\partial^2 \hat{M}_i}{\partial u_1^2}\right] \text{var}(u_1) + \frac{1}{2}\left[\frac{\partial^2 \hat{M}_i}{\partial u_2^2}\right] \text{var}(u_2) = M_i.$$

It is important to recognize that this proposition does not show that the reciprocal cost allocation rates are unbiased estimates of the expected marginal costs of operating the service departments. Instead, the proposition demonstrates that, in general, the disturbance terms in the inter-service departmental production functions will have a "small" effect on the expected value of the reciprocal cost allocation rates. By a "small" bias, we mean that a Taylor series expansion to two terms of the reciprocal cost allocation rates is unbiased. Moreover, if the disturbance terms are symmetrically distributed about zero, a Taylor series expansion to three terms is also unbiased.[9]

However, it is easy to construct an example in which the bias is nonzero. Assume that u_1 and u_2 are independently distributed with $\text{Prob}(u_i = -1450) = \text{Prob}(u_i = 1450) = \text{Prob}(u_i = 0) = 1/3$. To focus on the effect of the u_i disturbance terms, assume that there is no uncertainty in the other equations. Specifically, assume that $Q_{1p} = Q_{2p} = 3000$, $f_{12} = f_{21} \doteq 0$, $b_{21} = b_{12} = .5$, $\beta_1 = \$9$, and $\beta_2 = \$12$. Given these parameters, the expected marginal costs for the service departments are $M_1 = \$20.00$ and $M_2 = \$22.00$. Simple calculations (using eq. (9)) yield that the expected values of the allocation rates are not equal to the expected marginal costs. In particular, $E(R_1/Q_1) = 19.984$ and $E(R_2/Q_2) = 22.016$. As discussed above, this bias is "small," but it is nonzero.

III. ALTERNATIVE PROCEDURES FOR ESTIMATING THE MARGINAL COSTS

The analysis in Section II focused on the expected values of the reciprocal cost allocation rates. In order to examine the *efficiency* of these allocation rates as estimates of the marginal costs of operating the service departments, they must be compared to estimates provided by other econometric procedures. The ideal benchmark would be the procedure that provides the most efficient estimates of the marginal costs. However, as discussed below, there is no econometric procedure that is unambiguously best (especially in small samples) given the structure of the production functions and traceable cost functions in equations (1) through (3). This section discusses three benchmark econometric procedures that provide consistent estimates of the marginal costs and the next section uses simulation procedures to compare the performance of the reciprocal cost allocation rates to the performances of these alternative methods.

Equation (5) indicates that a straightforward means of estimating the expected marginal costs is to conduct a multiple regression of $(C_1 + C_2)$ on Q_{1p} and Q_{2p}. The error term, e, in the multiple regression given by equation (5) contains disturbance terms which are *independent* of the explanatory variables in the regression. Therefore, the slope coefficients of the multiple regression will be unbiased estimates of the marginal cost parameters. In fact, multiple regression will result in best linear unbiased estimates relative to other estimation techniques which utilize only the total cost $(C_1 + C_2)$ and the quantities of service provided to the production department (Q_{1p} and Q_{2p}). However, the multiple regression approach does not utilize all of the information that is available in the system of equations (1) through (3). In particular, it does not utilize the information about the individual traceable costs of the service departments (C_i), the quantities of service provided between service departments (Q_{ij}), or the total quantity of service provided by each service department (Q_i).[10]

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[9] Although the standard deviations of the estimates could be calculated in a similar fashion, the expressions are complex and are not presented here. In the simulation procedure section, the standard deviations of the estimates generated by the reciprocal cost allocation method are compared with other estimators of the expected marginal costs using simulation techniques.

This suggests that more efficient estimators of the expected marginal costs can be obtained from econometric techniques which use data regarding the individual costs and quantities of the service departments.[11,12] In order to obtain efficient estimates of the parameters of equations (2) and (3), we exploit the structure of these two sets of equations. In particular, it is efficient to estimate the parameters of equation (2) separately from the parameters of equation (3).[13] Since the disturbance terms v_i are assumed to be independent, the traceable cost functions of the two service departments (specifically, the parameters β_1 and β_2) can be separately estimated using ordinary least squares (OLS) without loss of efficiency. However, the most efficient procedure for estimating the parameters of the inter-service department production functions is more involved than the simple single-equation form used for the traceable cost functions. In particular, the simultaneous relation between Q_1 and Q_2 implies that the independent variables (Q_j) and the disturbance terms (u_i) in equation (2) are not independent. To see this, one can solve equation (2) for the Q_j in terms of the Q_{ip} and u_i to derive:

$$Q_j = \frac{1}{1 - b_{ij} b_{ji}} \{f_{ji} + Q_{jp} + u_j + b_{ji}(f_{ij} + Q_{ip} + u_i)\}. \qquad (10)$$

These equations imply that the variables Q_j and u_i are positively correlated. Therefore, if b_{21} and b_{12} are estimated using OLS on two *separate* equations, the resulting estimates for the parameters of equation (2) will be inconsistent.[14] To obtain consistent estimators for the system of simultaneous equations, two-stage least squares (TSLS) and maximum likelihood estimators are used to estimate the parameters of equation (2) since they have desirable asymptotic properties. However, it is important to note that relatively little is known about the efficiency of these estimators in small samples or in situations in which the underlying distribution for the observed variables is non-Normal (for the case of maximum likelihood estimators).[15]

In the first stage of the TSLS procedure, instrumental variables for Q_1 and Q_2 are constructed by conducting multiple regressions of each Q_i on Q_{1p} and Q_{2p} (these regressions are analogous to estimating the intercepts and slope coefficients of eq. (10)). The estimated coefficients from the first stage are used to develop predictions (or instruments) for Q_1 and Q_2. These instruments, denoted $\hat{Q}_1$ and $\hat{Q}_2$, are then used as the explanatory variables in the second stage. That is, the second stage regressions are:

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[10] For example, if the total quantity of service provided by a service department is "unusually" high or low given the quantity of service provided to the production department (i.e., the disturbance term u_i is nonzero), this information is ignored by the multiple regression approach. By ignoring the disturbance terms in equation (2), the multiple regression approach essentially groups these terms into the error term (as can be seen in eq. (5b)). The resulting increase in the variance of the error term will, all other things equal, increase the variance of the estimates of the slope coefficients.

[11] Note that the reciprocal cost allocation method *does* make use of this information.

[12] The possibility of obtaining more efficient estimates of the parameters M_i through the use of less aggregated data provides a justification for treating the service departments as two separate cost centers, rather than one large service department.

[13] The separability of the estimation process is possible because the disturbance terms u_i and v_i are assumed to be independent and because none of the dependent variables in equation (3) appear as independent variables in equation (2).

[14] For example, given the parameters used in the subsequent simulation, the expected values of the OLS estimates for b_{21} and b_{12} are both equal to .740. If these numbers are used to predict the expected marginal costs, the estimates of M_1 and M_2 would be \$38.46 (assuming the traceable variable cost of the service departments were known to be \$10 each), which are almost double the true value of \$20.

[15] For example, in small samples, the two-stage least squares estimators can be biased. See Judge et al. [1985, pp. 609-613] for a discussion of the small sample properties of TSLS and ML estimators.

$$Q_{ij}=\gamma_{ij}+\delta_{ij}\hat{Q}_j+\zeta_i. \qquad (11)$$

The slope coefficients δ_{12} and δ_{21} from the second-stage regressions will be consistent estimates of b_{12} and b_{21}, respectively.

The maximum likelihood (ML) estimation assumes that the variables (Q_{1p}, Q_{2p}, Q_1, and Q_2) are distributed as multivariate normal random variables. Given this structure, the variance-covariance matrix of the observed variables can be calculated as a function of the individual parameters of this system of equations. The ML estimates are that set of parameters whose theoretical variance-covariance matrix most closely "fits" the estimated variance-covariance matrix of the observed variables. Unfortunately, the equations that characterize the solution are too complex to be solved in closed form. Therefore, the ML estimates for these parameters are calculated using a numerical procedure.[16] Given the above assumptions, the ML estimates of the parameters b_{ij} can be shown to be consistent and asymptotically efficient.

To summarize, econometric procedures (either TSLS or ML) are used to provide consistent estimators of the individual parameters of equations (2) and (3). Substituting these estimates into equation (5c), the parameter M_i is estimated using:

$$\hat{M}_i=\frac{\hat{\beta}_i+\hat{\beta}_j\hat{b}_{ji}}{1-\hat{b}_{ij}\hat{b}_{ji}} \qquad (12)$$

As discussed above, the advantage of this procedure is that it utilizes more of the information that is available in the system of equations (1) through (3). One disadvantage is that the individual estimates of β_i and b_{ij} are combined in a nonlinear fashion in equation (12), making it difficult to assess the statistical properties of the estimates for M_i. For example, even if the estimates of all of the individual parameters are unbiased, the estimates of M_i may be biased because of the effect of the random variables in the denominator of equation (12).

However, the asymptotic properties of $\hat{M}_i$ are easier to determine. In particular, it is straightforward to show that the estimation procedure discussed above will result in consistent estimators for M_i. This follows directly from the consistency of the estimators of the individual parameters in equation (12), and from the facts that the probability limit (plim) of the quotient of two random variables is the quotient of the two plims, the plim of the product of two random variables is the product of the two plims, and the plim of the sum of two random variables is the sum of the two plims. Therefore, when the individual parameter estimates are combined in equation (12), the resulting estimate for M_i is consistent; i.e., plim $(\hat{M}_i)=M_i$.

IV. DESCRIPTION OF SIMULATION PROCEDURE

Although it is easy to analytically calculate the statistical properties of the multiple regression estimates, the sampling distributions of the reciprocal cost allocation rates, the TSLS estimators, and the ML estimators cannot be derived in closed form. For this reason, we will examine the sampling distribution of all four estimation procedures using the simulation techniques described below. In each iteration of the simulation, N periods of data are generated to form an "estimation period." The parameters M_1 and M_2 are estimated using the N periods of data from the estimation period using each of the estimation procedures described above. These estimates can be used to make operating decisions in period $N+1$. The simulation process is then repeated 500 times, and the empirical distribution of the estimates is calculated. To provide some evidence on both the small-sample and the "asymptotic" properties of these estimation procedures, the analysis is conducted with $N=20$ and $N=200$.

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[16] The numerical procedures are conducted using an algorithm that is commonly referred to as LISREL that is described in Joreskog and Sorbom [1984].

The reciprocal cost allocation method is frequently discussed in textbooks as being applied to a single period of data. However, it is clear that the accuracy of the reciprocal cost allocation rates can be improved if multiple periods of data are used to derive the allocation rates. The following procedure allows the reciprocal cost allocation method to utilize all N periods of data from the estimation period. First, OLS regressions are applied to the N periods of data from the estimation period in order to estimate the parameters of the traceable cost functions of the service departments ($\hat{\alpha}_i$ and $\hat{\beta}_i$). On the basis of these estimates, the traceable variable cost of service department i in any period is estimated to be $\hat{\beta}_i Q_i$. For each of the N periods, the traceable variable cost estimates and the quantities of service provided for that period are substituted into the reciprocal allocation formulas (eq. (7)) to compute a reciprocal cost allocation rate for that period. The *mean* of these allocation rates from the N periods in the estimation period is used as the estimate of the marginal cost of operating the service department in the $N+1^{st}$ period. This procedure allows the reciprocal cost allocation method to utilize the *same* set of data the other estimation procedures employ, thereby ensuring a fairer comparison among the estimation procedures.[17]

The parameters of the simulation process are chosen to yield an expected marginal cost of operating each service department equal to \$20. The variables Q_{1p} and Q_{2p} are generated as independent normally distributed random variables with mean 3000 and variance 200*200.[18] The total quantities of service are then generated using equation (10), with the disturbance terms u_i independently distributed with mean 0 and variance 400*400. The parameters of the inter-service department production functions are $b_{12}=b_{21}=.5$. Finally, the parameters of the traceable cost functions are $\alpha_1=\alpha_2=\$100{,}000$ and $\beta_1=\beta_2=\$10$. The disturbance terms v_i are generated indepen-

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[17] To provide some evidence on the performance of the reciprocal cost allocation method applied to a *single* period of data, we also conducted a simulation analysis of the reciprocal cost allocation rate for only the last period of the estimation period. The quantities of service for period N and the estimate for the traceable variable cost for period N were substituted into the reciprocal cost allocation formula to derive an estimate for the parameters M_i. The means of the allocation rates were essentially the same as those reported in Tables 1 and 2. Interestingly, the standard deviations of the allocation rates based only on the data from period N were only slightly larger than those of the allocation rates that use all N periods of data (by approximately 11 percent). This result occurs because the N individual allocation rates are highly correlated. The high correlation arises because all N of the individual allocation rates rely on the same estimates for the parameters β_i, and the variance of the estimates for β_i are large relative to the variance in the percentages of service given the specific parameters used in the simulation.

[18] In order to examine the sensitivity of the estimation procedures to the correlation between Q_{1p} and Q_{2p}, we also conducted the simulation with Q_{1p} and Q_{2p} positively correlated (which would be expected if each b_{ip} is positive and the output of the production department, Q_p, is stochastic). Specifically, the variances of Q_{1p} and Q_{2p} were equal to 200*200, and their correlation was .679. The standard deviation of the MR estimates were significantly increased by the introduction of a positive correlation between Q_{1p} and Q_{2p}. However, the performances of the other three methods were relatively unaffected.

TABLE 1

COMPARISON OF THE ESTIMATES OF THE EXPECTED MARGINAL COSTS OF OPERATING THE SERVICE DEPARTMENTS PROVIDED BY THE RECIPROCAL COST ALLOCATION METHOD (RA), MULTIPLE REGRESSION (MR), TWO-STAGE LEAST SQUARES (TSLS), AND MAXIMUM LIKELIHOOD (ML) PROCEDURES

(500 Iterations, 20 Periods of Data in Each Estimation Period)[a]

Value of f_{ij} for Simulation[b]	*RA*			*MR*	*TSLS*	*ML*
	0	*−250*	*+1500*	*All*	*All*	*All*
Panel A. Estimates for M_1 (True Value=20):						
Mean[c]	20.00	18.46	30.03	21.65	23.41	17.42
Median	20.02	18.53	30.12	21.18	21.60	17.87
Q3	21.78	20.18	32.75	31.68	30.08	21.72
Q1	18.00	16.81	27.24	9.89	15.32	13.80
Standard Deviation	2.66	2.58	3.88	15.22	13.24	7.58
MSE	7.08	9.03	115.65	234.37	186.92	64.11
Panel B. Estimates for M_2 (True Value=20):						
Mean	20.07	18.45	30.10	20.56	23.58	17.16
Median	20.18	18.37	29.98	19.60	22.30	18.09
Q3	22.10	20.40	32.91	29.10	30.05	21.70
Q1	18.15	16.67	27.41	9.37	15.70	13.70
Standard Deviation	2.82	2.58	4.02	14.19	12.67	7.69
MSE	7.96	9.06	118.17	201.67	173.34	67.20

[a] The estimates of the marginal cost parameters are constrained to lie within the interval [0,80].

[b] The parameter f_{ij} is the intercept in equation (2). Since the estimates provided by the MR, TSLS, and ML are unaffected by the magnitude of f_{ij}, only one set of results is presented for each of these three methods.

[c] Notation: Q3 is the third quartile of the 500 estimates, Q1 is the first quartile, and MSE is the mean-squared error relative to the parameter value of 20.

dently with mean 0 and variance 5000 *5000.

Simulation Results

Table 1 contains the simulation results for the case in which the estimation period contains 20 observations. Using the same set of randomly generated disturbance terms, we simulated data using three different levels for the intercepts of the inter-service department production functions: $f_{12}=f_{21}=0$, $f_{12}=f_{21}=-250$, and $f_{12}=f_{21}=1500$. The first three columns of Table 1 contain the results of the reciprocal cost allocation method for these three levels of f_{ij}. Since the multiple regression, TSLS, and ML estimates for the marginal costs do not depend on the value of f_{ij}, only one set of results is presented for each of these three estimation techniques.

The results of these simulations indicate that the mean value of the reciprocal cost allocation rate (RA) is only close to the marginal cost (i.e., 20) when $f_{ij}=0$. Consistent with the predictions developed previously, the mean value is approximately equal to 18.33 when $f_{ij}=-250$, and approximately equal to 30 when $f_{ij}=1500$. The means of the multiple regression estimates, which can be analytically shown to be unbiased, are much closer to the true value of 20 than the means of the RA estimates when f_{ij}

$\neq 0$. However, the standard deviations of the multiple regression estimates are large relative to the standard deviations of the RA estimates.

The standard deviations of the estimates that employ TSLS and ML procedures are also large relative to the standard deviations of the RA estimators. In fact, the standard errors of the estimates generated by these two procedures (especially the TSLS procedure) were so large that they sometimes produced estimates that were inconsistent with prior knowledge about the production process (e.g., that the marginal costs are positive). To reduce the effect of these outliers on the comparisons, the estimates of the marginal costs parameters were winsorized to lie in the range [0,80] in the results reported in Table 1.[19] Despite the considerable reduction in the standard deviations of the estimates that is achieved via the winsorization process, the standard deviations of the TSLS and ML estimates are still much greater than those of the RA estimators.

Table 2 reports the results of repeating the simulation process with 200 periods of data in the estimation period. As the length of time over which the inter-service department production functions are "stable" increases, a greater number of periods can be used to extract the variable portion of these functions. This will reduce the variance of the allocation rates under all four methods. However, the bias that exists in the reciprocal cost allocation rates will not be reduced as the length of the estimation period is increased. The results in Table 2 indicate that the mean estimates provided by the MR, TSLS, and ML methods are extremely close to the true value of 20. This result follows from the fact that these methods can all be analytically shown to provide consistent estimates of the marginal costs.[20] The allocation rates provided by the TSLS and ML estimators were much better behaved (e.g., all of the allocation rates were in the [8,30] range, so there was no need to winsorize the estimates). As in Table 1, the RA estimates were biased whenever the true intercepts in the inter-service department production equations were nonzero. Also consistent with Table 1, the standard deviations of the RA estimates were lower than the standard deviations of the other methods.

Since the RA, TSLS, and ML procedures all use OLS for estimating the traceable variable cost function, the differences in their performance must arise from the differences in the way these procedures estimate the parameters b_{ij}. Both the bias and the lower standard deviation of the RA estimates are the result of the RA method's implicit use of the inverse of the average physical product instead of the inverse of the marginal physical product of the inputs to the ser-

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[19] That is, the negative estimates were reset to equal zero to reflect the fact that the expected marginal costs cannot be negative. The unreasonably high estimates were reset to a value of 80, which is an admittedly arbitrary choice. More sophisticated procedures for dealing with outliers, such as including constraints in the estimation of equation (2) to ensure that each b_{ij} is positive and that $(1-b_{12}b_{21})$ is also positive, or using Bayesian estimation to incorporate prior beliefs about the marginal costs, are beyond the scope of the paper. It seems unlikely that these more sophisticated procedures would result in the standard deviations of the TSLS estimates being lower than the standard deviations of the RA estimates.

[20] Note that the TSLS and ML methods, which utilize more of the information that is available about individual costs and quantities of service than does the MR method, perform significantly better than the MR method. Also, the ML method appeared to consistently outperform the TSLS method. This result occurs because the simulation was conducted in the specific environment for which the ML estimation method was designed. In particular, the disturbance terms in equations (2) and (3) were simulated to have a normal distribution, which is the distribution that the ML method assumes in calculating its estimates. It is possible that the TSLS estimates may perform better when the assumption of normality is violated.

Table 2

Comparison of the Estimates of the Expected Marginal Costs of Operating the Service Departments Provided by the Reciprocal Cost Allocation Method (RA), Multiple Regression (MR), Two-Stage Least Squares (TSLS), and Maximum Likelihood (ML) Procedures

(500 Iterations, 200 Periods of Data in Each Estimation Period)

Value of f_{ij} for Simulation[a]	*RA* 0	*RA* −250	*RA* +1500	*MR* All	*TSLS* All	*ML* All
Panel A. Estimates for M_1 (True Value=20):						
Mean[b]	20.07	18.40	30.12	19.80	20.22	19.79
Median	20.10	18.43	30.13	19.58	20.03	19.89
Q3	20.67	18.97	30.93	23.27	22.20	20.93
Q1	19.47	17.83	29.29	16.38	18.11	18.80
Standard Deviation	0.83	0.77	1.19	5.01	3.04	1.63
MSE	0.69	3.15	103.08	25.14	9.29	2.70
Panel B. Estimates for M_2 (True Value=20):						
Mean	20.03	18.36	30.09	19.77	20.12	19.82
Median	19.99	18.31	30.03	19.86	20.09	19.82
Q3	20.62	18.91	30.91	22.76	22.07	20.84
Q1	19.47	17.82	29.28	16.60	17.98	18.98
Standard Deviation	0.82	0.76	1.18	4.72	3.14	1.52
MSE	0.67	3.27	103.20	22.33	9.87	2.35

[a] The parameter f_{ij} is the intercept in equation (2). Since the estimates provided by the MR, TSLS, and ML are unaffected by the magnitude of f_{ij}, only one set of results is presented for each of these three methods.

[b] Notation: Q3 is the third quartile of the 500 estimates, Q1 is the first quartile, and MSE is the mean-squared error relative to the parameter value of 20.

vice departments. In particular, the RA method is able to calculate a relatively precise estimate of the inverse of the average physical product, whereas the TSLS and ML procedures are only able to produce a relatively noisy estimate of the inverse of the marginal physical products.

To further explore this issue, equation (8) implies that the RA method implicitly estimates the average physical product in a period to be $b_{ij}+(f_{ij}+u_i)/Q_j$. As long as the total quantity of service, Q_j, is large relative to the variance of u_i, the RA method will provide a relatively precise estimate of the average physical product. That is, the RA method's implicit estimate of the average physical product is analogous to conducting a regression analysis with the intercept suppressed. As long as the independent variable of the regression (i.e., Q_j in eq. (2)) is large, the estimate of the slope coefficient that is produced by this procedure will have a low standard deviation. This procedure, however, will produce a biased estimate of the true slope coefficient if the model's true intercept is nonzero.

In contrast to the RA method, the TSLS and ML procedures produce consistent estimates of the inverse of the marginal physical product, but at the cost of an increase in the standard deviation of the estimates. The imprecision in the estimates of the parameters b_{ij} can adversely affect the estimates of the expected marginal costs in three ways. First, if the estimate of either b_{ij} is negative, this can cause the estimates for the expected marginal cost to be negative. Second, if the product of the estimates for b_{12} and b_{21} exceeds one, the estimated marginal costs will be negative. Finally, if the product of $\hat{b}_{12}$ and $\hat{b}_{21}$ is very close to one, the term $1-\hat{b}_{12}\hat{b}_{21}$ in the denominator of equation (12) will approach zero, and this will cause the estimates to be unreasonable.

Overall, the results in Tables 1 and 2 indicate that the reciprocal cost allocation rates give biased estimates of the expected marginal costs of operating the service departments. However, the RA estimates exhibit much smaller variances than the estimates produced by procedures which attempt to reduce this bias. One way to combine the bias and efficiency measures into a single index is to compute the mean-squared error, which is the sum of the square of the bias (relative to the true value of 20) and the square of the standard deviation of the estimates. The results in Tables 1 and 2 indicate that if all f_{ij} are zero, the reciprocal cost allocation rates are approximately unbiased and produce the most efficient estimates of the marginal costs of operating the service departments. The results also demonstrate that the mean-squared error for the RA estimates increases as a function of the magnitude of the intercepts (f_{ij}) from equation (2), whereas the mean-squared errors of the MR, TSLS, and ML estimates are not a function of f_{ij}. Taken together, these results imply that there is a cutoff value of f_{ij} below which the reciprocal cost allocation is superior to the other methods.[21] This cutoff level for the parameter f_{ij} is a decreasing function of the number of periods of data available in the estimation period.

V. SUMMARY

Prior research (see Kaplan [1973]) has examined models in which the marginal costs of operating service departments are equal to the allocation rates that are generated via the reciprocal cost allocation method. On the basis of this result, the managerial accounting literature frequently suggests that the reciprocal cost allocation method is the "best" method for allocating service department costs when reciprocal services exist (see Horngren and Foster [1987, p. 427] and Jacobs and Marshall [1987]). This paper examines the properties of the reciprocal cost allocation rates in a more realistic setting by (1) allowing for a more general production function for the service departments than has previously been considered in the literature, and (2) explicitly incorporating uncertainty in the model. We demonstrate that the underlying parameters of interest in the model, which are the expected marginal costs of operating the service departments, are given by the same formula as in Kaplan's model. However, the allocation rates derived from the reciprocal cost allocation method can be *biased* estimates of the expected marginal costs in this more general setting.

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[21] The optimal trade-off between bias and efficiency, of course, will depend upon the particular decision-making context being considered. A more complete analysis would compare the usefulness of the estimation techniques in a decision-making context (see Demski and Feltham [1972]). In particular, the decision maker would use the estimates of the parameters of M_1 and M_2 to update his or her prior distribution regarding these parameters. The posterior distribution would then be used in making a decision such as whether an additional unit of service should be provided internally or purchased externally. In order to determine how to use the parameter estimates of M_1 and M_2 to update his or her priors, the decision maker must be able to specify the sampling distribution of the parameter estimates, which is the focus in this paper.

In particular, the reciprocal cost allocation rates are biased estimates of these expected marginal costs if the service departments operate at a point on their production functions at which the marginal physical product is *not* equal to the average physical product of their inputs. This inequality will exist, in general, whenever the service department production functions are nonlinear, even if they can be perfectly approximated by linear functions over the range of output in which the service departments operate. Under these circumstances, the reciprocal cost allocation rates will include a "fixed cost" component even though the allocation procedure is applied only to the traceable variable costs of the service departments.[22]

We also analyzed the performance of three econometric procedures (multiple regression, two-stage least squares, and maximum likelihood) that provide consistent estimators of the marginal cost of operating the service departments. Simulation results indicated that the standard deviations of the estimates derived from these techniques were much larger than the standard deviation of the reciprocal cost allocation rates. Because the estimates of the marginal costs provided by the reciprocal cost allocation method have a greater degree of bias, but a lower standard deviation than the estimates provided by the other methods, none of the methods is unambiguously best (especially in small samples). However, as more data becomes available to estimate the parameters of the production functions and traceable cost functions, the estimates provided by the more sophisticated econometric techniques (especially the maximum likelihood estimates) were superior to those provided by the reciprocal cost allocation method.

APPENDIX

Sketch of the Proof of Proposition 2:

Using a Taylor series expansion of $\hat{M}_1$ to two terms about the means of u_1 and u_2 implies:

$$E(\hat{M}_1) \approx M_1 + \frac{1}{2}\left[\frac{\partial^2 \hat{M}_1}{\partial u_1^2}\right] \mathrm{var}(u_1) + \frac{1}{2}\left[\frac{\partial^2 \hat{M}_1}{\partial u_2^2}\right] \mathrm{var}(u_2) \tag{A1}$$

where the partial derivatives are evaluated at $u_1 = u_2 = 0$ (i.e., at their expected values).

Assuming $f_{12} = f_{21} = 0$, the allocation rate for department one is

$$\hat{M}_1 = \frac{N}{D}$$

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[22] Of course, there may be some decision-making setting in which the parameter of interest is the *average* physical product of the service department production functions. In such a setting, the reciprocal cost allocation method does provide an estimate of the parameter of interest. However, to our knowledge, the only justification that appears in the literature for the superiority of the reciprocal cost allocation method is based on the relation between the reciprocal cost allocation rates and the *marginal* costs of operating the service departments.

where:

$N=\beta_1+\beta_2\hat{b}_{21}$,

$D=1-\hat{b}_{12}\hat{b}_{21}$, and

$\hat{b}_{ij}=b_{ij}+\dfrac{u_i}{Q_j}$.

Therefore,

$$\frac{\partial^2\hat{M}_1}{\partial u_1^2}=\frac{D^2\dfrac{\partial^2 N}{\partial u_1^2}-DN\dfrac{\partial^2 D}{\partial u_1^2}-2D\dfrac{\partial N}{\partial u_1}\dfrac{\partial D}{\partial u_1}+2N\dfrac{\partial D}{\partial u_1}\dfrac{\partial D}{\partial u_1}}{D^3}. \tag{A2}$$

Before calculating the partial derivatives on the right-hand-side of equation (A2), we use equation (8) to derive the following intermediate results:

$$\frac{\partial\hat{b}_{12}}{\partial u_1}=\frac{Q_2(1)-u_1(\partial Q_2/\partial u_1)}{Q_2^2}\Bigg|_{u_1=u_2=0}=\frac{1}{E(Q_2)}. \tag{A3}$$

Similarly, evaluating the partial derivatives at $u_1=u_2=0$, results in:

$$\frac{\partial^2\hat{b}_{12}}{\partial u_1^2}=\frac{-2b_{21}}{1-b_{12}b_{21}}\frac{1}{E(Q_2)^2}\text{, and} \tag{A4}$$

$$\frac{\partial\hat{b}_{21}}{\partial u_1}=\frac{\partial^2\hat{b}_{21}}{\partial u_1^2}=0. \tag{A5}$$

Substituting equations (A3) through (A5) into the definitions of N and D yields:

$$\frac{\partial N}{\partial u_1}=\beta_2\frac{\partial\hat{b}_{21}}{\partial u_1}=0 \text{ and } \frac{\partial^2 N}{\partial u_1^2}=\beta_2\frac{\partial^2\hat{b}_{21}}{\partial u_1^2}=0.$$

$$\frac{\partial D}{\partial u_1}=-\hat{b}_{21}\frac{\partial\hat{b}_{12}}{\partial u_1}-\hat{b}_{12}\frac{\partial\hat{b}_{21}}{\partial u_1}=\frac{-b_{21}}{E(Q_2)}$$

$$\frac{\partial^2 D}{\partial u_1^2}=-\hat{b}_{21}\frac{\partial^2\hat{b}_{12}}{\partial u_1^2}-2\frac{\partial\hat{b}_{21}}{\partial u_1}\frac{\partial\hat{b}_{12}}{\partial u_1}-\hat{b}_{12}\frac{\partial^2\hat{b}_{21}}{\partial u_1^2}=\frac{2b_{21}^2}{1-b_{12}b_{21}}\frac{1}{E(Q_2)^2}.$$

Substituting these results into equation (A2) yields:

$$\frac{\partial^2\hat{M}_1}{\partial u_1^2}=\frac{-DN\dfrac{\partial^2 D}{\partial u_1^2}+2N\dfrac{\partial D}{\partial u_1}\dfrac{\partial D}{\partial u_1}}{D^3}=\frac{N}{D^3}\left[-\frac{2b_{21}^2}{[E(Q_2)]^2}+2\frac{b_{21}^2}{[E(Q_2)]^2}\right]=0.$$

Similarly, it can be shown that:

$$\frac{\partial^2\hat{M}_1}{\partial u_2^2}=0 \text{ when evaluated at } u_1=u_2=0.$$

Substituting into equation (A1) proves the result. The proof for M_2 is similar.

Q.E.D.

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Taxpayers' Reporting Decisions and Auditing Under Information Asymmetry

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ABSTRACT: This study examines the effects of uncertainty on taxpayers' reporting decisions in conjunction with economic factors. Previous research is extended by (1) simultaneously modelling taxpayers' reporting decisions and the tax agency's audit policies, (2) incorporating taxpayers' uncertainty about the tax agency's audit costs and uncertainty about their tax liabilities, and (3) investigating the effects of both transferable monetary and nontransferable penalties for underpayment of taxes. The analysis shows that tax liability uncertainty can have different effects upon taxpayers' reporting decisions than uncertainty about the audit cutoff point. Furthermore, these specific effects will depend upon the presence or absence of monetary penalties and the anticipated audit probability in the initial equilibrium which, in turn, depends upon the penalty and tax rates. Specifically, increased tax liability uncertainty will induce more taxpayers to report a high level of income under proportional monetary penalties, but sometimes can have the opposite consequences under fixed, nontransferable penalties. Similar results also hold with respect to tax rate changes. The findings have direct implications for experimental studies of taxpayers' reporting behavior and potential policy implications for the effects of changes in the tax laws and reduction in tax and penalty complexity both of which would likely affect taxpayers' uncertainty.

TAXPAYER compliance behavior has attracted considerable attention among both policy making bodies and academic researchers. Early modelling studies (see Witte and Woodbury [1983], Graetz and Wilde [1985], Skinner and Slemrod [1985], and Jackson and Milliron [1986] for reviews) used a decision-theory framework in which taxpayers are assumed to know the (fixed) audit probability and the applicable penalty rate for underpayment of taxes (see Allingham and Sandmo [1972], Yitzhaki [1974], and Koskela [1983]). Taxpayers in these models are assumed to know

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their taxable incomes and associated liabilities, but may intentionally understate their taxable incomes when the resulting gains exceed the expected penalty cost of audit.

Recently Alm [1988], Beck and Jung [1989], Scotchmer [1988], and Scotchmer and Slemrod [1989] have extended these models by incorporating uncertainty about tax liabilities. All of these studies, however, retain the traditional assumption that the penalties for underpayment of taxes are proportional to the tax deficiency (or underreported income in Alm [1988]). Furthermore, these studies also have assumed that taxpayers view the audit probability as being invariant with respect to the amount of taxable income declared (e.g., deductions taken). As the nature and magnitude of deductions taken by taxpayers could influence their audit probability, taxpayers' expected payoffs and optimal reporting decisions could change.

Graetz et al. [1986] and Reinganum and Wilde [1986] have generalized the fixed audit probability models by employing game theory. An important contribution of these models is to incorporate directly the strategic interplay between taxpayers' reporting decisions and the tax enforcement agency's audit strategy. Reinganum and Wilde [1988b] also incorporate taxpayers' uncertainty about the tax agency's audit costs, but the consequences of tax liability uncertainty in a strategic setting have not yet been investigated.

While uncertain about their tax liabilities, taxpayers in the present model are assumed to have private information about the transactions underlying their taxable income as reflected by their probabilistic beliefs. Hence, taxpayers' reports may convey some of this information and, thus, allow the tax enforcement agency to revise its expectations regarding the benefit of auditing taxpayers. Information asymmetry about the tax enforcement agency's audit technology allows the agency to avoid having to precommit to an audit probability schedule, thereby enabling the information contained in taxpayers' reports to be utilized to a greater extent than in previous models.

Previous studies have typically assumed that penalties for underpayment of taxes are proportional to the (post-audit) tax deficiency and are transferred to the tax enforcement agency. When uncertainty exists regarding tax liabilities, however, taxpayers may be able to claim substantial authority for their positions and, thereby, avoid these monetary penalties.[1] Under such circumstances, the penalty borne by taxpayers will represent the opportunity cost of time spent preparing for the audit, professional fees paid to tax advisors, and disutility for the audit experience. Since these costs would not necessarily vary proportionately with the amount of underpaid taxes and would not be transferred to the tax enforcement agency, tax auditing policies and taxpayers' reporting decisions both could be affected. Hence, this study compares the effects of fixed, nontransferable penalties with those of proportionate monetary penalties.

The remaining sections of the paper are organized as follows: Section I provides a further background and discusses the issue of taxpayer compliance under uncertainty. Section II presents the basic model and statement of a theorem regarding the existence of equilibria. The analytical comparative statics results are presented in Section III followed by a further analysis of the penalty structure in Section IV. Finally, Section V presents a summary of results and their implications.

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[1] Section 6661 of the Internal Revenue Code (see U.S. Congress [1987]) prescribes a monetary penalty of 20 percent of the amount of substantial tax underpayments and interest thereon.

I. BACKGROUND

The effects of tax law complexity and uncertainty have only recently been investigated.[2] Friedland [1982] manipulated taxpayers' uncertainty about the probability of a tax audit in an experimental context and found that increasing the level of uncertainty enhanced compliance. However, Reinganum and Wilde [1988b] demonstrated analytically that, when taxpayers are risk-neutral, increasing their uncertainty about the tax agency's cutoff point for conducting audits can either enhance or diminish compliance.

When taxpayers and the tax agency both have uncertainty about taxable income, difficulties arise in applying traditional concepts of taxpayer compliance (or evasion) as there is not a single absolute standard ("true tax liability") against which taxpayers' reporting decisions can be evaluated. Such uncertainty could exist, for example, if courts in different jurisdictions have issued conflicting rulings or if taxpayers' particular circumstances differ from those in previous rulings. To the extent that taxpayers' reported incomes and associated liabilities fall within the range of possible values due to such uncertainty, it is arguable that compliance exists.[3]

Given the absence of an unambiguous measure of compliance, studies involving tax liability uncertainty have typically focused upon directional changes in reported income. In an experimental context, Milliron [1985] found that increased tax law complexity did not have a consistent directional effect on her subjects' tax reporting judgments. Modelling studies [Alm, 1988; Scotchmer and Slemrod, 1988; and Beck and Jung, 1989] also have found that the effects of increased taxpayer uncertainty about tax liabilities depend upon a variety of conditions including taxpayer risk-taking attitudes, penalties, and the perceived audit probability. All of these results are predicated on the assumption that taxpayers face proportional monetary penalties for underpayment of taxes and view the audit probability as being insensitive to their reporting decision. Hence, it is unclear whether similar results would obtain if the proportional penalties were absent or strategic interplay were to occur between taxpayers and the tax enforcement agency.

II. MODEL

Assume that taxpayers have private information about the transactions underlying their taxable incomes, but are uncertain about their tax liabilities and the tax enforcement agency's costs of performing audits. Similarly, the tax agency is assumed to have uncertainty about taxpayers' taxable incomes and the potential benefit (incremental revenue) that would be obtained by auditing taxpayers' returns. Since taxpayers make the first decision, the tax agency will attempt to infer taxpayers' private information from the tax returns to revise their expectations regarding the audit benefit. In equilibrium, taxpayers must recognize how their tax returns will affect the expected audit benefit assessed by the tax agency and take this into account when making their reporting decisions.

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[2] The relations between taxpayer complexity, uncertainty, and compliance are discussed by Slemrod [1988] who identifies two general aspects of complexity: *predictability* of the tax law and *enforceability*. To the extent that complexity makes identification of the "correct" tax liability costly or difficult for taxpayers, Slemrod argues that taxpayers will have greater uncertainty about their tax liabilities and, thus, are likely to increase their reported incomes. Complexity also has been defined operationally in terms of several factors including: ambiguity, number of computations, changes in the law, amount of detail, record keeping, and forms (see Long and Swingen [1987]). Lee [1987] investigated taxpayers' and the tax agency's incentives to resolve uncertainty due to complexity by having advance rulings.

[3] Such a perspective is implicit in Section 102.01 of the AICPA [1987] Code of Professional Ethics which states: "A member shall not knowingly misrepresent facts. . . . In tax practice, a member may resolve doubt in favor of his client as long as there is reasonable support for his position." Internal Revenue Service Regulation Section 1.6661-3(a)(2) states that reasonable support is a position that is "arguable, but unlikely to prevail in court."

As the starting point in model development, consider a taxpayer who is uncertain about his or her taxable income and associated liability when preparing a tax return. For tractability, assume that there are only two taxable (and reportable) income levels, high (H) and low (L). The difference between these two income levels and associated tax liabilities might be due to the deductibility of an expenditure or the inclusion of income from a particular transaction. Based upon private information about the transactions and any special circumstances affecting the taxable income level, the taxpayer assesses a probability (p) for the event that the post-audit taxable income will be high (e.g., deduction will be disallowed) and the complementary probability ($1-p$) for the low income event. The taxpayer's transactions and circumstances are unknown to the tax agency, so different taxpayer types are defined by their beliefs, p. Due to the sequential nature of the model, the tax agency's audit decision will be analyzed before considering the taxpayer's reporting decision.

Tax Agency's Audit Decision

Prior to making audit decisions, the tax agency sorts taxpayers into audit classes having shared observable characteristics. Based upon prior (e.g., demographic) information, the tax agency assesses a (prior) probability distribution for the taxpayer types comprising the audit class. The prior density, denoted by $f(p)$, has [0,1] support and a mean,

$$\bar{p} \equiv \int_0^1 pf(p)\,dp.^{4}$$

Assuming the tax agency is risk neutral and behaves rationally (i.e., attempts to maximize expected tax revenues net of audit costs), there is no motivation for auditing taxpayers who have already reported a high taxable income on their tax returns.[5] Hence, the tax agency's audit decision needs only consider taxpayers within a given audit class who have reported a low taxable income. If an audit is performed on a low income return and the taxable income is determined to be high, then the tax agency can impose a monetary penalty for underpayment of taxes. Consistent with the extant institutional environment in the U.S., the penalty initially is assumed to be proportional to the amount of the tax underpayment identified by the audit (see fn. 1). In Section IV, the model will be modified to deal with the case where the taxpayer would be successful in claiming

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[4] The location and shape of $f(p)$ will depend upon the demographic characteristics of the taxpayers comprising a given audit class. For example, if high (low) income taxpayers predominate, $f(p)$ would have a high (low) mean and skewness to the left (right). The IRS routinely obtains such information through its Taxpayer Compliance Measurement Program (TCMP). The TCMP data base is suitable for constructing discriminant analysis models to select taxpayers' returns for audit. When discriminant analysis is used, taxpayers' returns are selected for audit when the conditional probability of filing an accurate return is sufficiently small in relation to a predetermined cutoff point.

[5] While other auditing considerations (e.g., equity, social costs of investigation errors) are possible (see Wertz [1979]), Melumad and Mookerjee [1986] have provided a rationale for the cost-benefit criterion. They have shown that the delegation of audit decisions to an agency whose rewards are based upon revenue collections in excess of incremental costs is Pareto efficient.

substantial authority for his or her position under U.S. law.

Given a proportional penalty and tax rate structure, the potential (incremental) revenue from performing an audit on a type p taxpayer who reports low income would consist of two components. The first is the additional tax collected, $t(H-L)$, while the second source is the revenue from penalties on the tax deficiency, $q(tH-tL)$, where t and q are tax and penalty rates, respectively. Since incremental revenue is obtained only when the taxpayer's per audit income is determined to be H (with probability p), the tax agency's expected benefit from auditing a known type p taxpayer is:

$$\begin{aligned} &p\{t(H-L)+q(tH-tL)\} \\ &=pt(1+q)(H-L). \end{aligned}$$

The tax agency will attempt to infer something about the taxpayer's type from observation of the reported income (i.e., revise its prior beliefs) before deciding whether to perform an audit. Since reported income (R) is binary (i.e., $R\epsilon\{L,H\}$), while there is a continuous distribution of taxpayer types (p) over [0,1], reported income only imperfectly reveals taxpayers' private information. Nevertheless, partitioning the distribution of taxpayer types into two groups based upon reported income provides additional information for the tax agency. Suppose the agency conjectures that all the taxpayer types below a certain cutoff p-value, P_c, will report low income, L, whereas all others will report H.[6] Then, $R=L$ would be a signal that a taxpayer's type belongs to the set $[0,P_c]$, and the tax agency would revise its prior belief about the taxpayer's type to the following:

$$f_L(p)=\begin{cases} \dfrac{f(p)}{F(P_c)} & \text{for } 0\leq p\leq P_c \\ 0 & \text{otherwise,} \end{cases}$$

where $f_L(p)$ is the posterior belief. An audit will be performed when the audit cost, c, is lower than the (posterior) expected benefit. That is, when

$$c<\bar{P}_L\cdot t(1+q)(H-L), \qquad (1)$$

where

$$\bar{P}_L\equiv\int_0^{P_c} p\cdot f_L(p)\,dp$$

is the tax agency's posterior mean of taxpayer types reporting $R=L$.

Taxpayer Reporting Decisions

Since the tax rate, income levels, penalty rate, and tax agency's prior beliefs are all exogenous common knowledge in the model, taxpayers can compute the tax agency's (posterior) expected audit benefit. However, unlike the tax agency, taxpayers do not know the agency's audit cost (or posterior mean cutoff point) and, thus, are uncertain as to whether their return will be selected for an audit. Taxpayers' probabilistic beliefs about the tax agency's audit cost are represented by a probability density function $g(c)$ having interval support $[c_L,c_H]$ where $c_L<c_H$. Given the tax agency's decision rule for performing audits in equation (1), taxpayers who report L will assess the following audit probability:

$$\int_{c_L}^{c^*} g(c)\,dc=G(c^*), \qquad (2)$$

where c^* denotes the expected audit benefit, i.e.,

$$c^*\equiv\bar{P}_L\cdot t(1+q)(H-L). \qquad (3)$$

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[6] This conjecture is certainly not the only one possible. However, one can verify that the difference between the taxpayers' expected tax (penalty) liabilities under the two reporting alternatives is a monotonic function of p (see eq. (6) below). Hence, it does not appear plausible that the tax agency would presume that some subset(s) of taxpayers having p-values greater (less) than P_c will report low (high) levels of income.

Alternatively, taxpayers reporting H anticipate a zero audit probability.[7]

Consistent with previous research (e.g., Reinganum and Wilde [1986 and 1988b]), assume that taxpayers are risk-neutral. Now consider a type p taxpayer who reports low income and, thus, is audited with probability $G(c^*)$. If no audit is conducted, the taxpayer's reported income L is the base upon which the tax liability is calculated, so the liability amounts to tL. In the event of an audit, there are two possible outcomes. If the audit determination is that taxable income is low, then the taxpayer's liability will remain tL. However, if the (post-audit) taxable income is high, then the taxpayer will bear both a monetary penalty $qt(H-L)$ and a revised tax liability of tH so the conditional (upon an audit) expected value of taxes and penalties would be $p(tH+qt(H-L))+(1-p)tL$.[8] Before the tax agency's audit decision is known, the taxpayer's expected value of the tax liability and penalties when reporting low income is represented by:

$$\begin{aligned} &G(c^*)\cdot[p\cdot(tH+qt(H-L)) \\ &\quad +(1-p)\cdot tL]+(1-G(c^*))\cdot tL \\ &\quad =G(c^*)\cdot p\cdot t(1+q)(H-L)+tL. \qquad (4) \end{aligned}$$

Alternatively, if the taxpayer reports high income, there will be no audit so the expected tax liability would remain tH, irrespective of the taxpayer's type. Thus, a type p taxpayer will have an incentive to report low income if:

$$G(c^*)\cdot p\cdot t(1+q)(H-L)+tL<tH. \qquad (5)$$

The inequality in equation (5) can be simplified and reformulated in terms of the taxpayer's type:

$$p<1/[(1+q)G(c^*)]. \qquad (6)$$

An implication of equation (6) is that taxpayers will report L (H) depending upon whether their type (p) is lower (higher) than the value of the right hand side of equation (6).

Equilibrium

The present model is based upon a sequential equilibrium (see Kreps and Wilson [1982]). In the present context, a sequential equilibrium requires that: (1) given its beliefs about the taxpayer's type (in particular, the conjectured cutoff p-value), the tax agency chooses an audit strategy which maximizes its expected payoffs; (2) given the tax agency's audit strategy based on the conjectured cutoff p-values for each possible audit cost c, each taxpayer type chooses a reporting strategy that maximizes expected payoffs; and (3) the tax agency's beliefs are consistent with taxpayer's optimal reporting strategies.

Confirmation of equilibrium properties (1) and (2) above is straightforward: For a cutoff p-value, P_c (and revised expected audit benefit c^*), the tax agency's cost-benefit comparison in equation (1) maximizes expected tax/penalty revenue net of audit cost. Furthermore, given the tax agency's audit strategy, each taxpayer who bases his or her reporting strategy on equation (6) minimizes expected tax/penalty payments. In order for the third equilibrium property to be satisfied, the tax agency's conjectured P_c must be identical to the cutoff p-value determined by taxpayers' optimal reporting strategies based on equation (6). That is, reporting low (high) income is optimal for all the taxpayer types lower (higher) than the tax agency's presumed P_c. From equation (6), this essentially requires that:

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[7] Note here that the maximum expected audit benefit equals $\bar{P}t(1+q)(H-L)$ and is obtained when $P_c=1$. It is assumed throughout the study that the maximum expected audit benefit exceeds the lowest possible audit cost c_L. Otherwise, a rather pathological equilibrium would exist in which all taxpayers report L, but audits are never performed.

[8] While taxpayers could have uncertainty about the penalty rate for underpayment of taxes, we simplify by assuming that q is common knowledge.

$$P_c = 1/[(1+q)G(c^*)]. \qquad (7)$$

The condition in equation (7) states that a borderline type P_c taxpayer is just indifferent between reporting low income and high income.[9] The equilibrium condition in equation (7) can be restated as:

$$P_c \cdot G(c^*) = 1/(1+q). \qquad (8)$$

An issue of interest here is whether or not such a P_c exists, and the following theorem demonstrates its existence and uniqueness.

Theorem 1:

1. If $G(\bar{c}) > 1/(1+q)$ where $\bar{c} \equiv \bar{p} \cdot t(1+q)(H-L)$ denotes the maximum possible expected audit benefit, then there exists a partially-separating (sequential) equilibrium which is characterized by a unique P_c such that $0 < P_c < 1$.
2. If $G(\bar{c}) \leq 1/(1+q)$, then a low-pooling equilibrium arises, in which tax agency audits occur, but all taxpayer types report low income, irrespective of their beliefs about taxable income.[10]

Proof: See the Appendix.

The existence of an equilibrium probability cutoff value (P_c) has clear implications for the amount of income reported by taxpayers in the economy.[11] Given a tax rate (t) and distribution of taxpayer types $f(p)$, an increase in P_c implies that more taxpayers will report low income in equilibrium leading to lower tax revenues (before audits). P_c also can be interpreted as an index of taxpayer aggressiveness or willingness to take questionable deductions or income exclusions (i.e., report low income). An important feature of this aggressiveness index is that taxpayers' reporting decisions within the audit class are evaluated with respect to their probabilistic beliefs. Basing this evaluation on taxpayers' information sets is necessary under the assumption of taxpayer and tax agency uncertainty since there is no perfect information standard (i.e., "true" liability) available for comparison.

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[9] One can verify using Jensen's inequality that the cutoff p-value which makes a risk-neutral taxpayer just indifferent between reporting L and H would make risk-averse taxpayers strictly prefer to report a high level of income. Hence, the presence of risk aversion would reduce the cutoff probability (P_c) relative to the present case in which taxpayers are assumed to be risk-neutral, thereby implying less aggressive taxpayer reporting.

[10] From equation (6) one can infer that taxpayers would have an incentive to report H if their type, $p > 1/[(1+q)G(c^*)]$. The existence of a high-pooling equilibrium would require that the latter inequality hold for *all* taxpayer types in the audit class. However, given our assumption that $f(p)$ has [0,1] support, there will always be some taxpayers whose probability of having a high income is arbitrarily close to zero, thus, precluding universal satisfaction of the above inequality as would be necessary for a high-pooling equilibrium.

[11] The intuition behind the uniqueness of the equilibrium P_c is as follows. First, as the tax agency's cutoff p-value (P_c) increases, *ceteris paribus*, the tax agency's expected audit benefit goes up (see eq. (3)). Since the audit probability anticipated by taxpayers increases, reporting L will be optimal for fewer taxpayers in the audit class, thus, leading to a decrease in the actual cutoff p-value (denoted by P_c^T). Thus, P_c^T is a monotonically decreasing function of the tax agency's presumed p-value (P_c). Further, as P_c^T effectively summarizes taxpayers' optimal reporting strategies, it can be interpreted as taxpayers' aggregate response function to the P_c that underlies the tax agency's audit strategy. Second, suppose from the tax agency's standpoint that more taxpayers report L than assumed by the tax agency (i.e., $P_c < P_c^T$). Then, the audit strategy based on such a P_c would not actually maximize the tax agency's expected payoffs: The actual audit benefits (determined by P_c^T) would be higher than the presumed audit benefits (based on P_c). Thus, the tax agency would fail to audit up to the point where incremental audit benefits equal audit costs. A parallel argument would show that the tax agency would overaudit in the opposite case where $P_c^T < P_c$. The tax agency, thus, maximizes its expected payoffs if and only if P_c coincides with P_c^T. Since the tax agency's strategy critically depends upon P_c, the identity function $P_c = P_c^T$ can be viewed as the tax agency's response function to taxpayers' strategies (summarized by P_c^T). Note, finally, that the tax agency's response function ($P_c = P_c^T$) is monotone increasing in taxpayers' strategies, while taxpayers' response functions are monotone decreasing in the tax agency's strategy. Therefore, the response functions could cross at most once, leading to a unique equilibrium.

Given the above interpretation of the cutoff high-income probability, there is a natural means of distinguishing between the conditions under which separating and pooling equilibria will exist. In effect, Theorem 1 says that a (unique) partially-separating equilibrium will exist when the maximum anticipated audit probability $G(\bar{c})$ and/or penalties for underpayment of taxes are sufficiently high to induce the subset of taxpayers whose income probabilities exceed P_c to report H. The latter would be most likely to occur when the tax agency's audit costs are low in relation to the audit benefit. Conversely, a low-pooling equilibrium will exist when audit costs are so large in relation to the audit benefit that the maximum audit probability anticipated by taxpayers is insufficient to induce *any* taxpayer to report H.[12]

III. COMPARATIVE STATIC ANALYSES

This section analyzes the effects of changes in model parameters on taxpayer reporting aggressiveness, the tax agency's audit benefit, and the anticipated audit probability in the separating equilibrium characterized in Theorem 1.

The effects of penalty rate changes on P_c can be seen by differentiating the equilibrium condition in equation (8) with respect to q,

$$\frac{\partial P_c}{\partial q}\cdot G(c^*)+P_c\cdot g(c^*)\cdot\frac{\partial c^*}{\partial q} = -1/(1+q)^2. \tag{9}$$

Since from equation (3),

$$\frac{\partial c^*}{\partial q}=\frac{\partial \bar{P}_L}{\partial P_c}\cdot\frac{\partial P_c}{\partial q}\cdot t(1+q)(H-L) + \bar{P}_L t(H-L),$$

equation (9) is rewritten as

$$\frac{\partial P_c}{\partial q} = -A^{-1}[P_c\cdot g(c^*)\bar{P}_L t(H-L) + (1+q)^{-2}], \tag{10}$$

where

$$A \equiv G(c^*)+P_c\cdot g(c^*)\cdot t(1+q)(H-L) \cdot\frac{\partial \bar{P}_L}{\partial P_c}.$$

Note that

$$\partial\bar{P}_L/\partial P_c = f(P_c)\cdot\int_0^{P_c} F(P)\,dp/\{F(P_c)\}^2$$

>0 (i.e., the posterior mean is an increasing function of P_c) and, therefore, A is positive. Since the bracketed term in equation (10) is also positive, the sign of $\partial P_c/\partial q$ is negative, meaning that a larger penalty predictably induces taxpayers to report less aggressively.

The effects of changes in the monetary penalty rate on the equilibrium audit benefit can be determined by differentiating c^* with respect to q:

$$\frac{\partial c^*}{\partial q}=\frac{\partial \bar{P}_L}{\partial P_c}\cdot\frac{\partial P_c}{\partial q}\cdot t(1+q)(H-L) + \bar{P}_L t(H-L). \tag{11}$$

---

[12] Note that as all taxpayer types report L in a low-pooling equilibrium, the tax agency will never observe H in equilibrium. Thus, to make the low-pooling equilibrium outcome sequential in the sense of Kreps and Wilson [1982], the tax agency's out-of-equilibrium beliefs (OEB) need to be specified regarding the taxpayer types who would report H (i.e., out-of-equilibrium message). The existence of this low-pooling equilibrium, however, is not sensitive to the nature of OEB in the current modelling context, because the tax agency's best response is invariant to OEB (i.e., not to audit taxpayers who report H remains optimal). Hence, the specification of OEB is obviated.

Substituting equation (10) into equation (11) and making use of the equilibrium condition in equation (8) yields:

$$\frac{\partial c^*}{\partial q}=\frac{t(H-L)}{(1+q)\bullet A}\bullet\left[\frac{\bar{P}_L}{P_c}-\frac{\partial \bar{P}_L}{\partial P_c}\right]. \qquad (12)$$

Note that equation (12) is zero only when

$$\frac{\bar{P}_L}{P_c}=\frac{\partial \bar{P}_L}{\partial P_c}, \text{ or:}$$

$$\frac{\partial \bar{P}_L}{\partial P_c}\bullet\frac{P_c}{\bar{P}_L}=1. \qquad (13)$$

The left hand side of equation (13) represents the responsiveness of the tax agency's posterior mean assessment, $\bar{P}_L$, to a change in P_c. This will be referred to as "posterior mean elasticity" (denoted by η). Thus, the equilibrium expected audit benefit will increase when the posterior mean is inelastic ($\eta<1$), whereas it will decrease if the posterior mean is elastic ($\eta>1$).[13] As for the intuition underlying these results, note that when the penalty rate changes, equation (3) indicates that the expected audit benefit is affected both directly due to the presence of q and indirectly by the change in the posterior mean. While an increase in the penalty will augment the expected audit benefit, a decrease in $\bar{P}_L$ (through a decrease in P_c) due to a higher penalty will diminish it. If $\bar{P}_L$ is elastic, an increase in the penalty causes the posterior mean (and, hence, the expected audit benefit) to fall to a greater extent, and this overwhelms the effect of the penalty increase, leading to a lower equilibrium audit benefit. A parallel argument can be made for an inelastic posterior mean.

Since the audit probability anticipated by taxpayers, $G(c^*)$ is a monotonically increasing function of the expected audit benefit, the same conclusions are applicable. In particular, $\eta<(>)1$ will imply that, as the penalty rate increases, so does the anticipated audit probability.[14] The following proposition summarizes the above results:

> *Proposition 1*: A larger monetary penalty rate leads to less aggressive taxpayer reporting. The equilibrium audit benefit and anticipated audit probability will both increase (decrease) as the penalty becomes larger if the posterior mean elasticity is less (greater) than one.

Other noteworthy comparative statics properties of the model are related to the effects of changes in the tax rate.

> *Proposition 2*: An increase in the tax rate (t) will result in a higher equilibrium audit benefit and anticipated audit probability, and less aggressive reporting in equilibrium.
>
> *Proof*: See the Appendix.

The taxpayer aggressiveness results presented in Propositions 1 and 2 are consistent with previous game-theoretic models (e.g., Graetz et al. [1986] and Reinganum and Wilde [1986 and 1988b]).[15] However, the audit benefit and anticipated audit probability results reported in both propositions differ from previous models. When either the penalty (q) or tax (t) rate increases, tax payers' anticipations regarding the audit probability are subject to two countervailing effects. First, as noted by Graetz et al. [1986], an increase in q (or t), *ceteris paribus*, enhances the audit benefit, thereby inducing a higher audit probability (direct effect). Recognizing this, however, Graetz et al. argued that taxpayers will become less aggressive, which in turn lowers the audit benefit. In their model, the direct effect of penalty changes is weaker than the indirect effect, so the equilibrium audit benefit and audit probability both decline. Similarly, increases in the tax rate have no effect upon the audit probability in the Graetz et al. model as both the direct and indirect effects are completely offsetting. Within our model, the indirect effects of both penalty and tax rate increases are weaker due to taxpayers' uncertainty about their post audit tax liability and the associated penalties. Since the direct effect is strengthened vis-à-vis the indirect effect, the equilibrium benefit and audit probability sometimes go up in response to penalty rate increases and always are elevated by tax rate increases.[16]

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[13] The magnitude of the elasticity parameter depends upon the prior distribution, $f(p)$. For the special case in which p has a uniform (prior) distribution, one can verify that $\eta=1.0$.

[14] In the proofs of the subsequent propositions, we shall determine the sign of the derivative of the anticipated audit probability $G(c^*)$ (instead of the derivative of the audit benefit c^*) with respect to parameters in question, as they are monotonically related.

[15] Reinganum and Wilde [1986 and 1988b] did not analyze the effects of tax and penalty rate changes on the equilbrium audit probability, so we are unable to make comparisons.

IV. UNCERTAINTY EFFECTS

In the first subsection, we consider the effects of mean-preserving changes in the dispersion of the audit cost distribution (a surrogate for taxpayers' uncertainty), followed by a parallel analysis of the effects of tax liability uncertainty.

Audit Cost Uncertainty

Assume (temporarily) that audit costs are distributed uniformly over $[c_L, c_H]$. A natural means of modelling changes in the taxpayer's uncertainty about the tax agency's audit cost is to vary the dispersion of the underlying probability distribution, while holding the mean (c_m) constant. Now construct a second uniform distribution $G_1(c)$ having support $[c_L-\epsilon, c_H+\epsilon]$, where $0<\epsilon<c_L$ is a perturbation parameter. By construction, $G_1(\bullet)$ has the same mean, but greater dispersion than $G(\bullet)$. The following relations hold between $G(\bullet)$ and $G_1(\bullet)$:

$$G(c)\leq G_1(c) \quad \text{for } c\leq c_m \equiv (c_H+c_L)/2, \tag{14a}$$

$$G(c)\geq G_1(c) \quad \text{for } c\geq c_m. \tag{14b}$$

The inequalities in equations (14a) and (14b) can be explained by the fact that, as both distributions are symmetric and have the same mean, they must cross at c_m, since $G(c_m)=G_1(c_m)=.5$. Now one can see how the equilibrium audit benefit, anticipated audit probability, and reporting aggressiveness are affected by additional uncertainty.

Proposition 3: If the initial equilibrium audit benefit is less than the mean of the audit cost distribution (i.e., $c^*<c_m$), then additional uncertainty about the audit (cost) cutoff point leads to less aggressive reporting and a higher equilibrium audit benefit and anticipated audit probability in the new equilibrium (i.e., $P_c^1<P_c$ and $G(c^*)<G_1(c_1^*)$, where P_c^1 and c_1^* denote, respectively, the cutoff p-value

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[16] Various modelling differences are probably responsible. First, Graetz et al. [1986] assumed that the tax agency uses a randomized audit policy. Thus, the increase in the expected revenue due to increases in q or t is discounted by the audit probability. A second distinguishing factor is that an exogenous subset of all taxpayers in the Graetz et al. model are assumed to always report honestly (and accurately since there is no uncertainty about the actual tax liabilities). Hence, the expected revenue is also discounted by the (complementary) probability that taxpayers report dishonestly. In our model, the expected revenue also is discounted by the $\bar{P}_L$ term in equation (3) to recognize that all audits of taxpayers reporting low income will not necessarily result in the finding of tax deficiencies. Unlike Graetz et al., in which the proportion of honest taxpayers is exogenous, the analogous discount factor ($\bar{P}_L$) in our model is endogenous as it depends upon the equilibrium cutoff probability (P_c) which, in turn, depends upon taxpayers' reporting incentives.

and the expected audit benefit (i.e., counterpart of c^*) associated with distribution, $G_1(\bullet)$). The opposite is true if $c^*>c_m$. Finally, if $c^*=c_m$, then uncertainty does not affect the audit probability or taxpayers' reporting decisions.

Proof: See the Appendix.

In practice, one might argue that the audit probability anticipated by taxpayers is lower than 0.5 (as is the case when $c^*<c_m$). Under such conditions, our analysis unambiguously predicts that increasing taxpayers' uncertainty about the tax agency's audit cost will result in a higher anticipated audit probability in the new equilibrium and less aggressive reporting. The uniform distribution property that is important in deriving the proposition is the single-crossing property as indicated by the inequality in equation (14). More generally, if $G_1(c)$ is obtained from $G(c)$ by means of a *single* mean-preserving spread in the sense of Rothschild and Stiglitz [1970], then there exists a c' such that

$$G(c)\leq G_1(c) \quad \text{for } c\leq c', \text{ but} \qquad (15a)$$

$$G(c)\geq G_1(c) \quad \text{for } c\geq c'. \qquad (15b)$$

The properties in equation (15) are the same as in equation (14), except for the threshold value's (c') replacing c_m. Accordingly, Proposition 3 will hold with a change from c_m to c', so additional audit cost uncertainty will continue to have the same divergent effects on the equilibrium audit benefit, anticipated audit probability, and taxpayer reporting decisions.

Our findings regarding audit cost uncertainty are similar to the results recently obtained by Reinganum and Wilde [1988b]. To see the intuition for this suppose that $c^*<c_m$ (perhaps even close to c_L) as would be the case when the audit benefit initially is low. Under these conditions, a mean-preserving increase in the cost range would increase the probability that the tax agency's costs will be lower than c^* and that an audit actually would be performed. Consequently, taxpayers would have incentives to become less aggressive (i.e., P_c would decline). Alternatively, when $c^*>c_m$ (perhaps close to c_H), a mean-preserving increase in the dispersion of audit costs will reduce the anticipated audit probability, thus encouraging more aggressive reporting.

Tax Liability Uncertainty

Changes in tax liability uncertainty under a proportional tax rate structure can be modelled by perturbing the initial taxable income levels, L and H. Letting $0<\Delta<L$ denote the taxable income perturbation term, the altered two taxable income levels become:

$$\{L-\Delta, H+\frac{1-p}{p}\Delta\}.$$

The expected taxable income for a type p taxpayer is given by:

$$(1-p)\bullet(L-\Delta)+p\bullet(H+\frac{1-p}{p}\bullet\Delta)$$

$$=(1-p)\bullet L+p\bullet H \qquad (16)$$

which is independent of Δ. On the other hand, the variance of the taxable income is:

$$(1-p)\bullet[p(H-L)+\Delta]^2$$

$$+p\bullet[(1-p)(H-L)+\frac{1-p}{p}\Delta]^2 \qquad (17)$$

which is strictly increasing in Δ. Hence, as changes in Δ capture the idea of mean-preserving spread [Rothschild and Stiglitz, 1970], the subsequent analysis considers how the cutoff p-value and equilibrium audit probability will change with Δ.

Proposition 4: Assuming that the monetary penalty is proportional to the tax deficiency, increased uncertainty about the tax liability results in a higher equilibrium audit benefit and anticipated audit probability and less aggressive reporting by taxpayers (i.e., $P_c^* < P_c$ and $c^* < c^{**}$, where P_c^* and c^{**} denote, respectively, the cutoff income probability and equilibrium audit benefit associated with the perturbed income distribution).

Proof: See the Appendix.

The intuition underlying Proposition 4 is predicated upon the effects that changes in uncertainty (Δ) have upon taxpayers' expected penalties and the equilibrium audit benefit. First, while increasing Δ gives taxpayers additional incentives to save taxes by reporting low income, the conditional expected value of potential penalties is also increased, thereby providing countervailing incentives. Second, an increase in Δ, *ceteris paribus*, augments the potential tax and penalty revenues from audits and will lead to a higher anticipated audit probability. Therefore, taxpayers will have stronger incentives to report H (reflected by a decrease in the cutoff p-value). Although the latter results in a lower posterior mean ($\bar{P}_L$) in the tax agency's audit benefit expression, the tax/penalty revenue effect predominates. Thus, in the new equilibrium, the audit benefit and anticipated audit probability both increase, while taxpayers' reporting aggressiveness declines.[17]

Nontransferable Penalties

The preceding analysis has relied upon two important features of the penalty structure. The first is that the monetary penalties are proportional to the tax deficiency, and the second is that the penalties are transferred to the tax agency. Although this penalty structure has been incorporated in numerous studies (e.g., Yitzhaki [1974], Koskela [1983], Graetz et al. [1986], Reinganum and Wilde [1986 and 1988b], Scotchmer [1988], Scotchmer and Slemrod [1988], and Beck and Jung [1989]), there is some question about the applicability of this penalty structure in the present context. Unlike previous studies, both taxpayers and the tax agency have uncertainty regarding their taxable income and associated liability. When such uncertainty is due to conflicting rulings, taxpayers (at least in some cases) would have a substantial authority defense available and, thus, would be able to avoid monetary penalties for underpayment of taxes.[18]

Even when avoidance of monetary penalties is possible, however, one might argue that implicit penalties or costs could be incurred when an audit occurs. There is disutility for the audit experience and an opportunity cost due to the lost time and resources required to prepare for an audit, and obtain tax and/or legal expertise. Such implicit penalties may not be strictly proportional to the (postaudit) tax deficiency as previously assumed. A further difference between these implicit penalties and proportional monetary penalties is that the former do not provide revenue to the tax agency. Consequently, the anticipated audit probability in the new setting would be lower than that under proportional penalty structure.

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[17] The effect on the tax agency's incentives to perform audits and taxpayers' anticipations regarding the audit probability, explains why the results in Proposition 4 differ from those in Beck and Jung [1989] in which the audit probability was assumed to be fixed. The role of taxpayers' anticipations regarding the tax agency's audit policies has been investigated by Beck et al. [1988].

[18] The authors are grateful to Richard Helleloid and one of the referees for independently bringing this to our attention. One means of accommodating the presence of such a penalty defense is to assume that monetary penalties are imposed (conditional upon an audit finding of a tax deficiency) with some probability, $\phi > 0$, where ϕ is common knowledge.

To analyze the sensitivity of our results to the assumed penalty structure, assume that: (1) the implicit penalty (cost) borne by taxpayers is independent of the (postaudit) tax deficiency, and (2) no penalty revenues are collected by the tax agency. The tax agency's expected benefit from performing an audit on a taxpayer in the audit class who reports low income is:

$$\hat{c} \equiv \bar{P}_L t(H-L). \tag{18}$$

The anticipated audit probability is $G(\hat{c})$, so a type p taxpayer who reports a low level of income will have an expected tax liability and penalties of:

$$G(\hat{c})[ptH+(1-p)tL+Q] +(1-G(\hat{c}))tL, \tag{19}$$

where Q denotes the fixed and nontransferable penalty cost. Since the corresponding expected tax liability from reporting a high level of income is tH, a type p taxpayer will have an incentive to report a low income when:

$$G(\hat{c})[ptH+(1-p)tL+Q] +(1-G(\hat{c}))tL<tH. \tag{20}$$

The above inequality is rewritten as:

$$p<1/G(\hat{c})-Q/[t(H-L)]. \tag{21}$$

Based upon the same logic as in Section II, equilibrium dictates that

$$\hat{P}_c=1/G(\hat{c})-Q/[t(H-L)], \tag{22}$$

where $\hat{P}_c$ is the cutoff p-value for taxpayers facing fixed, nontransferable penalties. A proof of the existence of a partially-separating equilibrium can be established from equation (22) by the same arguments presented in the proof of Theorem 1 and, thus, is omitted.

Theorem 2:

If $G(\bar{c})>t(H-L)/[Q+t(H-L)]$ where $\bar{c} \equiv \bar{p}t(H-L)$, then there exists a unique partially-separating (sequential) equilibrium characterized by a cutoff p-value ($\hat{P}_c$) such that $0<\hat{P}_c<1$.

While the condition in Theorem 2 is similar in certain respects to that presented in Theorem 1, there is an important difference. The tax rate now explicitly appears on the right hand side of the equilibrium condition due to the fact that penalties are no longer tied explicitly to the tax deficiency.

Propositions 5 and 6 indicate how changes in the magnitude of the penalty and the tax rate affect the equilibrium audit benefit, anticipated audit probability, and taxpayers' reporting aggressiveness.

Proposition 5: An increase in nontransferable penalties will result in a lower equilibrium audit benefit and anticipated audit probability, but less aggressive reporting.

Proof: The proof parallels that of Proposition 1 and, thus, is not presented.

The finding regarding tax reporting is consistent with Proposition 1, but the equilibrium audit benefit and the anticipated audit probability now unambiguously decrease. An increase in the penalty induces less aggressive reporting (i.e., a decrease in $\hat{P}_c$ and posterior mean $\bar{P}_L$), and since the penalty is nontransferable, there is no compensating increase in the penalty revenues collected by the tax agency. Hence, the audit benefit and anticipated audit probability both decline unequivocally.

Proposition 6: Given nontransferable penalties, an increase in the tax rate will increase the equilibrium audit benefit and anticipated audit probability, but will have ambiguous effects upon taxpayers' reporting aggressiveness. However, the condition, $\hat{P}_c < [G(\hat{c}) - \hat{c}g(\hat{c})] \cdot G(\hat{c})^{-2}$, is sufficient to ensure that taxpayers' reporting becomes more aggressive.[19]

Proof: See the Appendix.

When the penalty is proportional to the tax deficiency as in Proposition 2, an increase in the tax rate indirectly increases the penalties for tax underpayment. As Yitzhaki [1974] noted, this indirect increase in penalties offsets the incentives which would otherwise exist for taxpayers to reduce reported income. When penalties are fixed and nontransferable, a tax rate increase no longer leads to a penalty increase, nor to as large an increase in the equilibrium audit benefit and anticipated audit probability. Consequently, taxpayers' incentives to report aggressively will not be discouraged to the same extent as under the proportional penalty structure analyzed in Proposition 2.

Given the differences observed between the effects of tax rate changes under the two penalty structures, one might hypothesize that the effects of uncertainty also could differ. Proposition 7 shows that increases in uncertainty about audit costs under fixed, nontransferable penalties have the same effects as under the proportionate penalty structure. However, in contrast to Proposition 4, Proposition 8 shows that increased tax liability uncertainty does not necessarily induce less aggressive reporting.

Proposition 7: Given fixed, nontransferable penalties, a mean-preserving increase in the dispersion of the (uniform) audit cost distribution will reduce (increase) taxpayers' reporting aggressiveness when the initial equilibrium audit benefit is less (greater) than c_m (the anticipated audit probability is less (greater) than .5) or have no effect upon reporting if the initial equilibrium audit benefit equals c_m.

Proof: The proof is similar to that of Proposition 3 and, thus, is omitted.

Proposition 8: Given nontransferable penalties, an increase in taxpayers' uncertainty about their tax liability increases the equilibrium audit probability, but has divergent effects upon taxpayers' reporting aggressiveness.

Proof: See the Appendix.

The audit cost uncertainty effects remain unchanged from Propositions 3 and 4 because the anticipated audit probability increases (decreases) when the initial equilibrium audit benefit is greater (less) than the cost mean regardless of whether the penalty is transferable and proportional to underpaid taxes. In contrast, however, the effects of changes in tax liability uncertainty depend on the penalty structure as is evident in Propositions 4 and 8. When penalties are fixed and nontransferable as in Proposition 8 the magnitude of potential penalties borne by taxpayers is independent of the tax liability and the tax agency has diminished incentives to perform audits. As neither of these reinforcing penalty effects is present, taxpayers' reporting aggressiveness is not discouraged to the same extent as when penalties were proportional to the tax deficiency and collected by the tax agency.

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[19] The above sufficient condition indicates that, when the initial $\hat{P}_c$ is smaller than a critical value, then tax reporting becomes more aggressive as the tax rate increases. As this critical value depends upon the audit cost distribution, however, further assumptions about the form and parameters of $G(\hat{c})$ are required in order to determine for what values of $\hat{P}_c$ the inequality holds.

TABLE 1

SUMMARY OF EFFECTS OF ENVIRONMENT FACTORS ON THE EQUILIBRIUM BEHAVIOR OF TAXPAYERS AND THE TAX AGENCY*

Environment Factor	*Penalties*	
	Monetary	*Nontransferable*
Penalty Increases:		
Taxpayer Reporting Aggressiveness	−	−
Tax Agency Audit Benefit and Probability	+/−	−
Tax Rate Increases:		
Taxpayer Reporting Aggressiveness	−	+/−
Tax Agency Audit Benefit and Probability	+	+
Increased Audit Cost Uncertainty:		
Taxpayer Reporting Aggressiveness	+/−	+/−
Tax Agency Audit Benefit and Probability	+/−	+/−
Increased Tax Liability Uncertainty:		
Taxpayer Reporting Aggressiveness	−	+/−
Tax Agency Audit Benefit and Probability	+	+

* The +/− symbols indicate divergent effects depending upon the specific parametric relations.

V. CONCLUSIONS AND IMPLICATIONS

The present study has developed a game-theoretic model of the interplay between taxpayers' reporting decisions and the tax agency's auditing policies in an environment characterized by uncertainty and information asymmetry. Conditions were identified under which taxpayers' reports provide a (partially revealing) signal to the tax agency regarding their private, but imperfect, information. Table 1 summarizes the major findings regarding how the anticipated audit probability and taxpayers' reporting decisions are affected by changes in the tax rate, penalty rate, audit cost uncertainty, and tax liability uncertainty.

Our major conclusions are that increases in penalties, the tax rate, and tax liability uncertainty diminish taxpayers' reporting aggressiveness when penalties are proportional to the tax deficiency and transferable to the tax agency. However, like Reinganum and Wilde [1988b] we find that incremental uncertainty about the tax agency's audit cost can either encourage or discourage reporting aggressiveness, depending upon the initial equilibrium audit benefit and the anticipated audit probability. Furthermore, when penalties are nontransferable and independent of the tax deficiency, increases in the tax rate and taxpayers' uncertainty about their tax liability may either encourage or discourage reporting aggressiveness by taxpayers. Hence, the effects of tax liability uncertainty depend upon the underlying penalty structure, while the effects of audit cost uncertainty are the same under both penalty structures.

A policy implication of the analysis concerns tax simplification efforts. Traditionally, the presence of tax law complexity has been rationalized as necessary to support various social objectives or has been blamed on the lobbying of tax professionals who are alleged to have a vested interest in preserving the status quo. However, our analysis suggests that, to the extent that such complexity creates tax liability uncertainty and taxpayers believe that they face proportional monetary penalties, the tax revenues based on reported income will be increased. Hence, the analysis predicts that the tax agency may not have strong incentives to support tax and penalty simplification.[20] Furthermore, the study also shows that, unless the anticipated audit probability in the initial equilibrium is greater than .5, increasing uncertainty about audit costs (as reflected in the tax agency's audit cutoff point) will likely result in less aggressive reporting. Hence, a rationale is also provided for the tax agency's nondisclosure of information about their audit strategy.

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[20] Concerns were raised recently during the September 1987 IRS Commissioner's Advisory Group Meeting regarding the confusion which exists with respect to the numerous penalty provisions contained in the Revenue Code (see Internal Revenue Service: Legislative Affairs Division [1987]). Accordingly, several studies have been commissioned by the IRS to identify areas where penalty provisions overlap and are confusing to taxpayers as a means of simplifying and improving their coordination.

APPENDIX

Proof of Theorem 1:

1. The left hand side of the equilibrium condition in equation (8) is continuous and monotone increasing in P_c with its value equal to zero and $G(\bar{c})$ when $P_c=0$ and 1, respectively. The right hand side is a strictly positive constant less than one. Accordingly, under the condition given in Theorem 1, there exists a unique value of P_c satisfying equation (8) such that $0<P_c<1$.
2. One can verify that, given the condition $G(\bar{c}) \leq 1/(1+q)$, the inequality in equation (5) holds for all $0 \leq p \leq 1$, implying that reporting low income is optimal for all taxpayer types.

Proof of Proposition 2:

Differentiating equation (8) with respect to t and rearranging terms yields:

$$\frac{\partial P_c}{\partial t} = -A^{-1}[P_c g(c^*) \cdot \bar{P}_L (H-L)(1+q)] < 0. \tag{A1}$$

The effects of tax rate changes on the tax agency's equilibrium audit benefit and taxpayers' anticipated audit probability can be determined by the sign of $\partial G(c^*)/\partial t$. Differentiating equation (8) yields:

$$\frac{\partial P_c}{\partial t} = \frac{-P_c}{G(c^*)} \cdot \frac{\partial G(c^*)}{\partial t}. \tag{A2}$$

Since $\frac{\partial P_c}{\partial t}<0$ from equation (A1), equation (A2) implies that $\frac{\partial G(c^*)}{\partial t}>0$.

Q.E.D.

Proof of Proposition 3:

Since the parameters other than $g(c)$ remain unaltered by ϵ, it must be true from the equilibrium condition in equation (8) that:

$$P_c \cdot G(c^*) = P_c^1 \cdot G_1(c_1^*). \tag{A3}$$

Proposition 3 is established by contradiction. Note that from inequality (14a), $c^* < c_m$ (i.e., the initial audit probability is less than .5) implies that:

$$G(c^*) < G_1(c^*). \tag{A4}$$

Now suppose the contrary, that $P_c \leq P_c^1$. Since the posterior mean and equilibrium audit benefit for each distribution are an increasing function of the cutoff p-value, the supposition implies that $c^* \leq c_1^*$. This result together with inequality (A4) implies by transitivity that:

$$G(c^*) < G_1(c_1^*). \tag{A5}$$

From (A3) and (A5), it must be the case that $P_c^1 < P_c$, which, however is contradictory to the supposition. Hence, when the initial audit probability is less than .5, it must be true that $P_c^1 < P_c$, which also implies, due to equation (A3), that $G(c^*) < G_1(c_1^*)$. Similar proofs can be developed for the cases in which the initial equilibrium audit benefit, $c^* \geq c_m$ (i.e., anticipated audit probability is greater than or equal to .5).

Q.E.D.

Proof of Proposition 4:

The expected benefit from auditing a low income tax return is given by

$$\bar{P}_L \cdot t(1+q)(H-L) + t(1+q)\Delta, \tag{A6}$$

and the audit probability anticipated by the taxpayer is $G(c^{**})$, where c^{**} equals (A6). Given this, a type p taxpayer would report the low income when

$$[pG(c^{**}) \cdot (1+q) - 1](H-L+\Delta/p)t < 0. \tag{A7}$$

The left hand side of (A7) is continuous in $p > 0$, and approaches $-\infty$ and $+\infty$ as p goes to zero and infinity, respectively. Further, it is monotone increasing in p. Hence, there exists a unique positive p-value, which equates the left hand side of (A7) to zero. If this unique value is less than one, a (partially) separating equilibrium dictates that this be equal to P_c^*, the tax agency's conjecture about the cutoff p-value. If the unique p-value is larger than unity, all taxpayers would report the low income and, thus, a pooling equilibrium would obtain. Assuming the separating equilibrium exists, it must be that:

$$t(H-L+\Delta/P_c^*)[P_c^* G(c^{**})(1+q) - 1] = 0. \tag{A8}$$

As the first term in (A8) is always positive, the second term must be zero, i.e.:

$$P_c^* G(c^{**})(1+q) = 1. \tag{A9}$$

The income uncertainty effect now can be analyzed by looking at the sign of $\partial P_c^*/\partial\Delta$. Differentiating equation (A9) with respect to Δ, one can verify that:

$$\frac{\partial P_c^*}{\partial \Delta} = -A^{-1}P_c^* g(c^{**})t(1+q)<0, \tag{A10}$$

where

$$A \equiv G(c^{**})+P_c^*\bullet g(c^{**})t(1+q)(H-L)\bullet\frac{\partial \bar{P}_L}{\partial P_c^*}.$$

The effect of the income uncertainty on the equilibrium audit benefit and the anticipated audit probability similarly can be verified:

$$\frac{\partial P_c^*}{\partial \Delta} = \frac{-P_c^*}{G(c^{**})}\bullet\frac{\partial G(c^{**})}{\partial \Delta}. \tag{A11}$$

Since $\frac{\partial P_c^*}{\partial \Delta}<0$, it follows from equation (A11) that $\frac{\partial G(c^{**})}{\partial \Delta}>0$.

Q.E.D.

Proof of Proposition 6:

Differentiating equation (22) implicitly with respect to t, one obtains:

$$\frac{\partial \hat{P}_c}{\partial t}\bullet B=[G(\hat{c})t(H-L)]^{-1}\bullet[\{G(\hat{c})\}^2\bullet Q-t(H-L)g(\hat{c})\bullet\hat{c}] \tag{A12}$$

where both

$B\equiv tG(\hat{c})+t^2P_cg(\hat{c})\frac{\partial \bar{P}_L}{\partial \hat{P}_c}(H-L)+g(\hat{c})Q\frac{\partial \bar{P}_L}{\partial \hat{P}_c}t$ and $[G(\hat{c})t(H-L)]^{-1}$ are positive.

It thus follows that the sign of $\partial\hat{P}_c/\partial t$ depends on the sign of the second bracketed term on the right hand side of equation (A12), which cannot be determined unambiguously. However,

$\frac{\partial \hat{P}_c}{\partial t}$ will be positive provided that: $[g(\hat{c})\hat{c}/G(\hat{c})^2]<Q/[t(H-L)]$.

Making use of the equilibrium condition in equation (22), the latter inequality can be rewritten as:

$$\hat{P}_c<[G(\hat{c})-\hat{c}g(\hat{c})]\bullet G(\hat{c})^{-2}. \tag{A13}$$

The effect on the equilibrium audit benefit and the anticipated audit probability depends on the sign of:

$$\frac{\partial G(\hat{c})}{\partial t}=B^{-1}\bullet g(\hat{c})\bullet\left[\frac{\partial \bar{P}_L}{\partial \hat{P}_c}t(H-L)(1-\hat{P}_c\bullet G(\hat{c}))+\bar{P}_L(H-L)tG(\hat{c})\right]. \tag{A14}$$

As the right hand side of equation (A14) is unambiguously positive, $\partial G(\hat{c})/\partial t>0$ as claimed.

Q.E.D.

Proof of Proposition 8:

Following the same approach as in Section IV, the (partially-separating) equilibrium condition for the case of fixed nontransferable penalties is given by:

$$G(c^n)\cdot[\hat{P}_c t(H-L)+t\Delta+Q]-\frac{t\Delta}{\hat{P}_c}=t(H-L) \tag{A15}$$

where $c^n(\equiv\bar{P}_L t(H-L)+t\Delta)$ represents the tax agency's expected audit benefit based on the perturbed income levels:

$$\{L-\Delta, H+\frac{1-p}{p}\Delta\}.$$

Differentiating equation (A15) with respect to Δ gives:

$$\frac{\partial\hat{P}_c}{\partial\Delta}\cdot D=\frac{t}{\hat{P}_c}-G(c^n)\cdot t-g(c^n)\cdot t\cdot\{\hat{P}_c t(H-L)+t\Delta+Q\} \tag{A16}$$

where:

$$D\equiv g(c^n)\cdot\{\hat{P}_c t(H-L)+t\Delta+Q\}\cdot\frac{\partial\bar{P}_L}{\partial\hat{P}_c}\cdot t(H-L)+G(c^n)\cdot t(H-L)+\frac{t\Delta}{\hat{P}_c^2}>0.$$

Using the equilibrium condition in equation (A15), equation (A16) is rewritten as:

$$\frac{\partial\hat{P}_c}{\partial\Delta}=[\Delta\cdot D]^{-1}\cdot[G(c^n)\cdot\{\hat{P}_c t(H-L)+Q\}-t(H-L)$$
$$-g(c^n)t\Delta\cdot\{\hat{P}_c t(H-L)+t\Delta+Q\}]. \tag{A17}$$

The right hand side of equation (A17) can either be positive or negative, and so can the sign of the term $\partial\hat{P}_c/\partial\Delta$.

The effect of increased tax liability uncertainty on the equilibrium audit benefit and the anticipated audit probability can be determined by the sign of:

$$\frac{\partial G(c^n)}{\partial\Delta}=D^{-1}\cdot t\cdot g(c^n)\cdot\left[\frac{\partial\bar{P}_L}{\partial\hat{P}_c}\cdot t(H-L)\cdot\left\{\frac{1}{\hat{P}_c}-G(c^n)\right\}\right.$$
$$\left.+G(c^n)\cdot t(H-L)+\frac{t\Delta}{\hat{P}_c^2}\right],$$

which is positive since $1/\hat{P}_c>1>G(c^n)$.

Q.E.D.

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NOTES

The Relation of Audit Contract Type to Audit Fees and Hours

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ABSTRACT: Audit contract type—fixed fee or cost-reimbursement—may affect audit fees and audit hours because of differences in both risk-sharing and incentives for efficiencies between the two types of contracts. It was hypothesized that under fixed fee contracting (1) audit fees would be higher or unaffected, and (2) audit hours would be lower. Instead, results indicate fixed fee contracts are associated with significantly lower audit fees and audit hours are not affected by contract type. The study also found that type of auditor (Big Eight or non-Big Eight), company ownership (public or closely-held), and time frame of audit performance (auditors' busy or non-busy season) was not related to contract choice. Finally, fixed fee contracting tended to be used more in early years of auditor/client relations. However, any pricing unique to initial engagements (e.g., price cutting behavior) did not explain significantly lower audit fees with fixed fee contracting.

In contracting for audit services, contract type is one choice variable. Contracts can be classified into two general types: fixed fee and cost-reimbursement. Under fixed fee contracts, auditor and client agree on a fee prior to the audit. The choice of contract type can alter assignment of risks between auditor and client and can influence auditors' incentives to conduct engagements in the most efficient (least cost) manner. Because of differences in risk-sharing and incentives for audit efficiencies, contract type can potentially affect both audit fees and audit hours. This study investigates the relation of contract type to audit fees and hours. It also provides insights into conditions surrounding the use of fixed fee and cost-reimbursement contracts in the audit services market.

The professional literature has long recognized contract type as an important choice variable in audit contracting (see Arens and Loebbecke [1984, p. 199] and Williams [1952]). In addition, regulators have revealed concern for this choice. For example, the SEC in ASR No. 250

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(effective September 30, 1978 and rescinded January 28, 1982) required proxy statement disclosure of direct or indirect understandings limiting current or future years' audit fees, including fixed fees not subject to reconsideration when encountering unexpected accounting or auditing issues. However, empirical research on the pricing of audit services has not pursued issues related to contract type (e.g., Francis and Simon [1987], Palmrose [1986], Simon [1985], Simon and Francis [1988], and Simunic [1980]).

Section I develops a conceptual framework for hypotheses tested in the study. Section II discusses sample selection and characteristics. Section III presents results. Final remarks and conclusions appear in Section IV.

I. CONCEPTUAL FRAMEWORK

In conducting audits, auditors require sufficient evidence to support rendering assurances that financial statements contain no material omissions or misstatements. Irrespective of contract type, professional and regulatory standards (e.g., AICPA [1983]), along with a penalty structure for noncompliance with standards, impose general requirements for sufficient evidence to support the auditor's assurances. Although auditing standards and procedures serve as a framework for acquiring evidence, each engagement is unique as to both audit entity and time-period. During the period under audit, clients' information processing and control systems, events and transactions, and cooperation, all influence the auditor's evidence acquisition. Therefore, at the time of contracting for an audit, uncertainty exists as to the nature and magnitude of evidence to be acquired. The term task uncertainty [Williamson, 1975] is used to describe this evidence acquisition uncertainty.

At audit contract negotiation, clients and auditors do not have identical information regarding potential evidence acquisition. Auditors may have more information than clients on audit procedures to be used to acquire evidence. Clients have more information than auditors on organization-specific factors (systems, cooperation, transactions, and events) related to the audit period that influence actual auditor evidence acquisition.

Contract type, fixed fee or cost-reimbursement, shifts task uncertainty risk between auditor and client. In general, with cost-reimbursement contracts, clients bear task uncertainty risk. Under cost-reimbursement contracting, total audit fees are determined after both contracting and audit evidence acquisition based on hourly or daily charges for actual time devoted to an engagement. A common approach develops standard rates for each category of audit personnel and applies these standard rates to time charged by that category plus any direct expenses. In essence, with cost-reimbursement contracts, auditors determine the nature and magnitude of audit evidence and clients provide reimbursement for actual time spent in acquiring evidence and forming an opinion. Under fixed fee contracting, fees are set in advance of performance and task uncertainty risk shifts to auditors. Auditors bear the consequences of deviations between expected and actual evidence acquisition.

In addition to differences in risk-sharing between clients and auditors, incentives for efficiencies in performance of audits are not necessarily similar for fixed fee and cost-reimbursement contracts. Fixed fee contracts generally provide greater incentives for least-cost performance of engagements since auditors retain any differences between costs and fees, when prespecified fees exceed costs.[1]

These differences in risk-sharing and incentives between fixed fee and cost-reimbursement contracts have implications for audit fees. But, unfortunately, the net effect is not unambiguous. To compensate auditors for assuming greater risk of task uncertainty, expected audit fees would be higher with fixed fee contracts. However, increased incentives for efficiencies with fixed fee contracts translate into lower expected audit fees.

Given this ambiguity, examination of the implications of contract type requires a second variable, in addition to audit fees. The second variable is total audit hours. Because of the labor-intensive nature of auditing, any efficiencies in audit performance would decrease the amount of time incurred by audit team members. This means that expected audit hours would be less with fixed fee contracts. Note, it is the reduction in audit hours that decreases expected audit fees under fixed fee contracting.

To summarize, the study examines the effects of contract type on total audit fees and audit hours. Two null hypotheses are tested:

H_{0_1}: There is no difference in audit fees between fixed fee and cost-reimbursement contracts.

H_{0_2}: There is no difference in audit hours between fixed fee and cost-reimbursement contracts.

Under *ceteris paribus* conditions, rejection of H_{0_2} in the direction of lower audit hours with fixed fee contracts, accompanied by either a failure to reject H_{0_1} or rejection of H_{0_1} with higher fees for fixed fee contracts, would be consistent with both increased efficiencies and greater risk of task uncertainty borne by auditors with fixed fee contracts.

The *ceteris paribus* conditions under which the hypotheses are formulated require some discussion. In reality, contract type, expected audit fees, and expected audit hours are jointly determined. This determination may be influenced by factors, including: audit quality, time frame for audit performance, and length of auditor/client relation. These factors require recognition in testing.

The predictions assume constant quality (level of audit assurance that financial statements are free of material error) across audits. If audit quality differs systematically between fixed fee and cost-reimbursement contracts, any lower audit hours or lower audit fees would be indicative of lower levels of service. To assess whether contract choices appear associated with any differential supply or demand for audit quality, two variables are used—type of auditor (Big Eight or non-Big Eight) and company ownership (public or closely-held). These variables are based on extant evidence. For example, Francis and Simon [1987] and Palmrose [1986] present findings consistent with the Big Eight as higher quality suppliers. Research on differential demand for quality in an agency cost setting [Francis and Wilson, 1988; Palmrose, 1984] suggests that public companies are a class of auditees with a potential demand for higher quality audit services.

Time frame of audit performance, i.e., off-season or busy-season audits, represents another factor that may influence contract choice, audit fees, and audit hours. To provide work for staff during slack periods, auditors might be willing to contract on a fixed fee basis at lower than normal fees, despite assuming greater risk of task uncertainty. Furthermore, fixed fee contracts during periods of slack demand would not necessarily create strong incentives for audit efficiencies. Client year-ends are used to proxy for the time frame of audit performance. Year-ends during November, December, and January are defined as busy season audits. Year-ends during all other months are defined as off-season audits.

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[1] Under cost-reimbursement contracts, auditors can agree to charge clients less than 100 percent of standard. Such contracts may provide incentives for efficiencies if audit firms have alternate higher-valued uses for audit personnel.

Finally, the study considers length of auditor/client relation. Given risks associated with task uncertainty, fixed fee contracts should be less likely to occur in early years of auditor/client relations when information disparities between client and auditor are likely to be greatest regarding organization-specific information.[2] Yet, evidence suggests that fixed fee contracts may be part of a response to competition for clients in an environment where auditors can benefit from advantages to incumbency (see Bowman [1985] and DeAngelo [1981]).[3] Tests are conducted for any systematic differences in the choice of contract types over the term of auditor/client relations to assess the role of this factor in contracting.

Audit quality, time frame for audit performance, and length of auditor/client relations do not exhaust the potential conditions that may influence the joint determination of contract type, audit fees, and hours. For example, the use of total audit hours does not consider any differences in the mix of audit firm personnel (e.g., partners, managers, seniors, and staff accountants) across engagements. To ensure that any differences in audit fees or hours do not reflect utilization of less experienced personnel, it would be desirable to examine for systematic differences between fixed fee and cost-reimbursement contracts in the use of categories of audit personnel. However, this analysis was precluded as audit hours by personnel categories were unavailable from data sources utilized for the study.[4]

To examine the relation of contract type to total audit fees and hours, relevant control and test variables are incorporated in a multiple regression model adapted from Palmrose [1986], as follows:

$$\begin{aligned} &\ell n(\text{Audit Fees}) \\ &\qquad \text{or} \qquad = b_0 + b_1 \ell n(\text{Assets}) \\ &\ell n(\text{Audit Hours}) \quad + b_2 \ell n(\text{Reports}) \\ &\qquad + b_3 \ell n(\text{Locations}) \\ &\qquad + b_4 RAI \\ &\qquad + b_5 PNP + b_6 ST \\ &\qquad + b_7 B8NB8 \\ &\qquad + b_8 YE + b_{9\text{-}18} IIV \\ &\qquad + b_{19} FFNFF \\ &\qquad + u \qquad (1) \end{aligned}$$

where, the dependent variable is either:

ℓn(Audit Fees) = natural log of audit fees,
or
ℓn(Audit Hours) = natural log of total hours worked by audit team,

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[2] This is consistent with historical professional literature. The *CPA Handbook* [1952] emphasizes that fixed fee contracting is not recommended on initial engagements, because auditors may not have the knowledge to make reasonable fee estimates [Williams, 1952, p. 10].

[3] Professional standards requiring communications between predecessor and successor auditors may help mitigate some risk of task uncertainty borne by auditors under fixed fee contracts with new clients.

[4] Because auditors considered client-specific information sought by the questionnaire as confidential, all data, including audit hours, were obtained from auditees. However, discussions with auditors supported the reasonableness of using auditees for data on audit hours. As a practical matter, on both fixed fee and cost-reimbursement engagements, auditors normally furnish clients with planned and actual hours. In addition, evidence suggests that clients do monitor audit team time incurred on engagements [Macchiaverna, 1981].

the independent control variables are:

ℓn(Assets) = natural log of total assets of client,
ℓn(Reports) = natural log of number of separate audit reports,
ℓn(Locations) = natural log of number of locations requiring on-site visits by auditors,
RAI = percentage reduction in audit fee or hours from auditee inputs (i.e., internal audit, internal control, and utilization of client personnel) as assessed by participants,
PNP = ownership indicator variable,

(1) public company, or
(0) closely-held company,

ST = report modification indicator variable,

(1) report modified (other than consistency exceptions from changes in GAAP), or
(0) all others,

*B*8*NB*8 = type of audit firm,

(1) Big Eight, or
(0) non-Big Eight,

YE = client year-end indicator variable,

(1) busy season audit, or
(0) non-busy season audit,

and

IIV = (ten) industry indicator variables;

and the test variable is:

FFNFF = indicator variable for type of contract,

(1) fixed fee, or
(0) cost-reimbursement;

and

u = error term.

Independent control variables are included to allow for possible effects of cross-sectional differences in client size (assets and reports), audit complexity (locations), client participation/substitution (*RAI*), audit risk (*PNP*, *ST*, *IIV*), type of audit firm (*B*8*NB*8), and client year-end (*YE*). Positive coefficients are expected for these variables except for *RAI* variable coefficient and coefficients for *IIV* variables in regulated industries (see Francis and Simon [1987], Palmrose [1986], Simon [1985], Simon and Francis [1988], and Simunic [1980]). A variable for length of auditor/client relation is added to the basic model using several different formulations for initial engagements as discussed in Section III.

To determine effects of contract type on both audit fees and hours, the model includes a test variable. The test variable (*FFNFF*) is an indicator variable, where (1) fixed fee engagement, and (0) cost-reimbursement engagement.

II. The Sample

Data from 361 companies issuing audited financial statements were obtained via questionnaires sent to an individual in the company considered most likely to be knowledgeable about contracting with public accounting firms (see Palmrose [1986]). The individual was usually a financial vice president, treasurer, or controller. The sample consists of both public and closely-held companies from a variety of industries, including: manufacturing, transportation, communications, electric and gas services, retail trade, financial services, and other services. Questionnaires were sent to companies from these industries using *Standard & Poor's*

TABLE 1
MEANS AND STANDARD DEVIATIONS OF THE INDEPENDENT AND DEPENDENT VARIABLES[1]
(1980-1981)

	Total Sample ($n=361$)[2]	*Fixed Fee Engagements* ($n=183$)	*Cost-Reimbursement Engagements* ($n=178$)
Audit Fees	$179,669 (424,251)	$172,392 (419,546)	$187,150 (430,090)
Audit Hours	3,414 (7,925)	3,382 (8,481)	3,446 (7,364)
Assets	$ 1,260MM (6,832MM)	$ 1,382MM (9,316MM)	$ 1,135MM (2,380MM)
Number of Reports	3.5 (7.9)	3.4 (8.2)	3.7 (7.6)
Number of Locations	3.1 (7.6)	3.3 (7.8)	2.9 (7.5)
Percentage Reduction in Fees or Hours from Auditee Inputs	17% (13%)	17% (13%)	17% (13%)
Percentage of Public Companies	75%	76%	73%
Percentage of Report Modifications	8%	10%	6%
Percentage of Big Eight Auditors	83%	83%	82%
Percentage of Busy Season Audits	69%	68%	71%
Years Client Had Retained Auditor	21 (16)	17 (16)	24 (15)

[1] Variables not transformed.
[2] For audit hours the number of observations is 302, 150, and 152 (respectively).

Register of Corporations, Directors, and Executives [1981] and *Who Audits America* [Harris, 1980] with a response rate of approximately 30 percent. Data represent the 1980-1981 time-period.

The type of fee contracting was assessed from responses to the following question:

> Was the total cost of the audit for the last fiscal year agreed on in advance as a fixed amount?
>
> (Yes or No) _______

Overall, 51 percent of the participants indicated that total audit cost was agreed on in advance as a fixed amount. As discussed in Section IV, some participants commented that their fixed fee contracts were subject to adjustment for changed or unexpected circumstances.[5]

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[5] Discussions with auditors reinforced that "yes" responses capture engagements where auditors provide clients with fixed estimates or quotations in advance of audit performance and both auditors and clients expect audit fees to equal prespecified amounts. Auditors were not surprised that 51 percent of the participants indicated fixed fee contracts, as fixed fee arrangements subject to adjustment for unexpected circumstances are considered common. However, arrangements not subject to renegotiation under any circumstances are considered rare. That is consistent with results of an Ernst & Whinney (EW) survey of 4,300 proxy statements filed from October 1, 1978 through June 30, 1979. The survey found only 12 had disclosures of fee limitations as required by the SEC [EW, 1980]. Perhaps more importantly, this illustrates that audit contracting involves a continuum of contract types not just the dichotomous classification used in this study. Section IV discusses this issue.

TABLE 2

REGRESSION RESULTS FOR AUDIT FEES AND AUDIT HOURS (1980–1981)

$$\ell n(\text{Audit Fees}) \text{ or } \ell n(\text{Audit Hours}) = b_0 + b_1 \ell n(\text{Assets}) + b_2 \ell n(\text{Reports}) + b_3 \ell n(\text{Locations}) + b_4 RAI + b_5 PNP + b_6 ST + b_7 B8NB8 + b_8 YE + b_{9\text{-}18} IIV + b_{19} FFNFF + u$$

	Dependent Variable			
	ℓn(Audit Fee) ($n=361$)		ℓn(Audit Hours) ($n=302$)	
	Coefficient	t-*statistic*	*Coefficient*	t-*statistic*
Intercept	1.978	6.131*	−1.551	−3.336*
Assets (log)	.467	26.933*	.446	17.779*
Number of Reports (log)	.194	5.596*	.122	2.458**
Number of Locations (log)	.232	6.365*	.276	5.353*
Reduction From Auditee Inputs	−.498	−2.907*	−.701	−2.869*
Public Ownership or Closely-Held	.342	5.592*	.320	3.683*
Audit Report Modification	.348	4.242*	.395	3.170*
Audit Firm Type	.232	3.314*	.210	2.043**
Busy Season Audit	−.005	−.082	.109	1.364
Industry Indicator Variables[1]				
Contract Type	−.100	−2.174**	−.025	−.377
F-statistic	$157.676^{*}_{19,360}$		$73.461^{*}_{19,301}$	
Adjusted R^2	.89		.82	

* Significant at the .01 level.

** Significant at the .05 level.

[1] The following industry indicator variable coefficients are significant at the .05 level, for ℓn(Audit Fee) as the dependent variable: electric/combination utilities (negative), savings and loans (negative), office equipment (positive), and retail trade (positive); and for ℓn(Audit Hours) as the dependent variable: electric/combination utilities (negative) and savings and loans (negative).

III. RESULTS

Table 1 provides means and standard deviations for dependent and independent variables (not transformed) in the model. Data are presented for total sample and two subsets of participants—those with fixed fee and those with cost-reimbursement engagements. As noted in Table 1, a reduced number of participants (302 of 361) furnished data on total audit hours. Of the auditees not furnishing audit hour data, 33 had fixed fee and 26 had cost-reimbursement engagements. However, the frequency with which audit hours data were furnished did not differ significantly ($p=.10$) between fixed fee and cost-reimbursement engagements (computed chi-square (1) is .78).

Table 2 presents regression results with ℓn(Audit Fees) and ℓn(Audit Hours) each as dependent variables. In each regression, control variable coefficients have the expected signs. The reasonableness of combining both fixed fee and cost-reimbursement engagements in one regression was examined and a Chow test could not reject the null hypothesis of equal regression parameters across data subsets.

Table 2 shows that contract type (*FFNFF*) coefficient is negative and statistically significant at the .05 level with

ℓn(Audit Fees) as dependent variable.[6] Thus, participants with fixed fee engagements do tend to have lower audit fees. Also, Table 2 shows the *FFNFF* coefficient is not statistically significant with ℓn(Audit Hours) as the dependent variable. Audit hours do not differ between fixed fee and cost-reimbursement engagements. These results suggest that the greater task uncertainty borne by auditors under fixed fee contracts is not reflected in a higher audit fee. The greater incentives for efficiencies under fixed fee contracts do not result in a reduction in audit hours.

The indicator variable for busy season audits is not significant at the .05 level in either regression. However, the busy season coefficient is significantly positive at the .10 level for audit hours. Since results appear consistent with contracting on a fixed fee basis to provide work for staff during slack periods, chi-square tests were conducted for differences between fixed fee and cost-reimbursement engagements regarding time-period of audit performance. Similar tests encompass the type of auditor and client company ownership. All tests are reported in Table 3.

The use of fixed fee contracts does not appear to be more characteristic of slack period audits (see panel A of Table 3). The computed chi-square is .469 and it cannot reject the null hypothesis of no association at even the .40 level.[7] Likewise, the use of fixed fee contracts does not appear to be more characteristic of Big Eight/non-Big Eight auditors or public/closely-held companies. Computed chi-squares cannot reject the null hypothesis of no association ($p=.40$) in either case (see panels B and C of Table 3). This analysis provides indirect evidence that choice of contract type does not reflect any systematic differences in supply or demand for audit quality.

Finally, the influence of length (term) of auditor/client relations on contract choice was examined. Table 1 shows number of years retained averages 17 years for fixed fee and 24 years for cost-reimbursement engagements. Higher usage of fixed fee contracts in earlier years of auditor/client relations becomes more evident in Table 4. Nearly 30 percent of participants with fixed fees retained their audit firm for five years or less, and 50 percent (29 percent + 21 percent) for ten years or less. In addition, 75 percent of companies that retained their audit firm for five years or less used fixed fee contracts. The computed chi-square for a 2×6 contingency table is significant at the .01 level in the direction of a greater number of fixed fee engagements than expected in earlier years of auditor/client relations.

The predominance of fixed fee contracts in early years of auditor/client relations suggests that auditors may assume greater risk of task uncertainty as part of a competitive process for initially obtaining and maintaining clients. As a consequence, the contract type variable (*FFNFF*) could be proxying for pricing unique to initial engagements. For example, Simon and Francis [1988] provide evidence on price cutting behavior during the first three years of continuing audit engagements.

To help determine whether pricing unique to initial engagements, rather than contract type, drives pricing regression results (i.e., lower audit fees on

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[6] Results for the *FFNFF* variable are not substantially altered if the regression with ℓn(Audit Fees) as the dependent variable is run using only the 302 observations with audit hours.

[7] The sample was also partitioned into two subsets—busy season audits ($n=250$) and non-busy season audits ($n=111$)—and the regressions estimated for each subset. With ℓn(Audit Fees) as the dependent variable the *FFNFF* coefficient was significant only in the busy season subset (coefficient $-.120$, t-statistic -2.178). With ℓn(Audit Hours) as the dependent variable the *FFNFF* variable coefficient was not significant in either subset.

TABLE 3

CLASSIFICATION OF FIXED FEE/COST-REIMBURSEMENT ENGAGEMENTS

($n=361$)

	Fixed Fee Engagements	*Cost-Reimbursement Engagements*	*Total*
Panel A. By Auditee Year-End (Auditor's Busy or Non-Busy Season):			
Year-End During Busy Season[1]	124	126	250
Year-End During Non-Busy Season	59	52	111
Total	183	178	361
Computed $\chi^2=.469_{ns}$			
Panel B. By Type of Auditor:			
Big Eight Auditor	152	146	298
Non-Big Eight Auditor	31	32	63
Total	183	178	361
Computed $\chi^2=.077_{ns}$[2]			
Panel C. By Type of Auditee:			
Public Company	139	130	269
Closely-Held Company	44	48	92
Total	183	178	361
Computed $\chi^2=.526_{ns}$			

[1] Year-ends during November, December, and January are classified as busy season year-ends. All other year-ends are classified as non-busy season.

[2] χ^2 statistics are not significant at the .40 level.

fixed fee engagements), the *FFNFF* variable was deleted and an indicator variable—(1) initial engagement, and (0) otherwise—was substituted in the regression with ℓn(Audit Fees) as dependent variable. Several specifications of initial engagements (see SEC [1978, p. 36] and Simon and Francis [1988]) were used including the following:

- years retained—two years or less (6 percent of sample),
- years retained—three years or less (11 percent of sample), and
- years retained—five years or less (20 percent of sample).

None of the coefficients for the indicator variable was significant at any meaningful level under any specification of initial engagement (remaining regression results were not substantially altered from those reported in Table 2). Thus, it appears lower audit fees with fixed fee contracting cannot be attributed to pricing unique to initial engagements.[8]

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[8] Regressions were also conducted with a variable for ℓn(Years Auditor Retained). The coefficient of this variable was not significant with ℓn(Audit Fees) as dependent variable, but it was significant with ℓn(Audit Hours) as dependent variable (coefficient −.085, t-statistic −2.170). This may indicate profit margins on engagements improve over time as audit fees do not

TABLE 4

CLASSIFICATION OF FIXED FEE/COST-REIMBURSEMENT ENGAGEMENTS BY NUMBER OF YEARS CLIENT HAD RETAINED AUDITOR

		Years					
	Total	*5 or Less*	*6–10*	*11–20*	*21–30*	*31–40*	*Over 40*
Cost-Reimbursement	178	18 (10% 25% 5%)[1]	24 (13% 38% 6%)	49 (28% 57% 14%)	35 (20% 62% 10%)	24 (13% 63% 6%)	28 (16% 60% 8%)
Fixed Fee	183	53 (29% 75% 15%)	39 (21% 62% 11%)	37 (20% 43% 10%)	21 (12% 38% 6%)	14 (8% 37% 4%)	19 (10% 40% 5%)
Total	361	71	63	86	56	38	47

Computed $\chi^2_{(5)}=29.95$
Table $\chi^2_{\alpha=.01}=15.09$

[1] Row percentage/Column percentage/Overall percentage

IV. FINAL REMARKS AND CONCLUSIONS

Dichotomization of contract types into fixed fee and cost-reimbursement fails to consider that neither type of contract is of a single form. Recall, some participants commented that their fixed fee contracts were subject to adjustment for changed or unexpected circumstances. This provision is of interest because, in addition to avoiding the need for proxy statement disclosures under SEC ASR No. 250, such a provision may help mitigate some risk of task uncertainty otherwise assumed by auditors with fixed fee contracts. Furthermore, cost-reimbursement contracts can include an estimated fee (or fee range) with auditors agreeing to communicate to clients when it is known estimated amounts will be exceeded. This commitment may somewhat alter risk-sharing and incentives for efficiencies.

While the study provides insights into the nature and effect of differences in audit fee contracts, further research would be required to satisfactorily explain lower fees on fixed fee engagements (with audit hours remaining unaffected). However, assuming total hours worked by audit firm personnel in conducting engagements reflect audit evidence acquisition, these results should alleviate concerns that reducing audit fees necessarily compromises audit performance (see Work [1985, p. 58]). In part, such concerns were behind the SEC ASR No. 250 disclosure requirements regarding fixed fee arrangements.

With fixed fee contracting, auditors bear greater risk of task uncertainty and auditors have greater incentives for efficiencies. As a consequence, it was hypothesized audit hours would be lower and audit fees would be unaffected or higher under fixed fee contracts. Instead, audit hours were not significantly affected by contract type and audit fees were significantly lower with fixed fee contracting.

In addition, the study found that type of auditor (Big Eight or non-Big Eight), company ownership (public or closely-held), and time frame of company year-end (auditors' busy or non-busy season) did not influence contract choice. However, it was found that fixed fee contracting tended to be used more in early years of auditor/client relations. Even so, price cutting behavior on initial engagements did not explain significantly lower audit fees with fixed fee contracting. Finally, the study recognized contract provisions that mitigate some differences between the two contract types in both risks of task uncertainty assumed by auditors and auditors' incentives for efficiencies.

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adjust downward but audit hours decrease. This would be consistent with DeAngelo's [1981] arguments as to pricing advantages to incumbency.

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Analogical Reasoning and Hypothesis Generation in Auditing

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ABSTRACT: The role of analogy and experience in hypothesis generation in preliminary analytical review is examined in an experimental setting. Subjects were 73 senior auditors and 51 auditing students. The transfer paradigm [Gick and Holyoak, 1980], in which subjects are first given a problem and its solution (source analog) and then given a problem to solve (target problem), was used in designing the experiment. The accounting error detected in the source analog was the only difference between the two treatment conditions (errors due to timing and performance). A third condition did not include a source analog and acted as a control. In the comparison between the control and timing conditions, expertise was significant ($p < .01$). In the comparison between the control and performance conditions, treatment and expertise were significant ($p < .05$). In the timing condition the more experienced subjects used a strategy based on domain specific knowledge rather than analogy. In the performance condition both experienced and inexperienced subjects used analogy. This difference in results between the timing and performance conditions can be attributed to the difference in expected frequency of the timing and performance hypotheses.

AUDIT judgments vary in relative structure and complexity. Abdolmohammadi and Wright [1987] indicate that it is the unstructured task that requires a high level of judgment and insight. They also note that unstructured, ill-defined problems require the greatest reliance on the accountant's skill or knowledge and, thus, it is these problems for which experience matters the most. To understand the nature of professional judgment and the role of experience in these unstructured problems, both the characteristics of the professional's specialized knowledge and the mechanisms for its utilization must be determined [Libby, 1985; Frederick and Libby, 1986].

One mechanism through which accounting professionals' specialized knowledge can be brought to bear on novel, unstructured, ill-defined problems is analogy [Marchant et al., in press; Johnson, in press; and Marchant, 1987]. Analogy is a reasoning mechanism used to extend knowledge to a particular problem that is on the surface un-

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familiar, by using relations contained in problems which are well understood and which have been solved. This paper provides evidence reflecting the utilization of this mechanism in a professional judgment setting where the level of experience is varied.

The use of analogy is examined in a preliminary analytical review setting. This setting is an unstructured segment of the audit where the professional is required to use a high level of judgment and insight to search for indications of various rarely occurring financial statement errors, many of which the auditor has not experienced first hand [Abdolmohammadi and Wright, 1987; Libby, 1985]. Analogical reasoning may be helpful in these situations because it could allow auditors to transfer their knowledge from a related familiar problem to a novel one. An experiment using the transfer paradigm [Gick and Holyoak, 1980] investigates the differences in the use of analogy by experts and novices in generating hypotheses about possible financial statement errors using analytical procedures.

The remainder of this paper is divided into four sections. The first section describes the rôle of analogy in hypothesis generation and how practical experience in the audit domain is expected to influence this use of analogy. This first section concludes with a description of the experimental hypotheses. In the second section, a description of the experiment, data collection, and data analysis is given. Results are reported in the third section. The final section discusses the conclusions and limitations.

I. Analogy and Knowledge Transfer During Hypothesis Generation in Diagnostic Tasks

Einhorn [1976] suggests that many of the unstructured problems of accounting can be characterized as diagnostic problems. As Libby [1985] indicates, the use of analytical procedures to detect potential financial statement errors is a typical accounting diagnosis problem. Hypothesis generation has been found to be the critical phase of a diagnostic procedure by research in other complex domains, such as medicine [Elstein et al., 1978]. Similarly, the auditor's generation of a hypothesis regarding an unusual fluctuation may be the critical phase in detecting a financial statement error. Libby [1985] examined the effects of a number of variables on the generation of hypotheses by auditors. These variables included:

1. Expectation about the frequency with which an error will occur.
2. Recent experience with an error.
3. Inheritance of a prior potential explanation.

Libby found that an error's perceived frequency of occurrence was strongly related to its availability as a potential explanation in an auditor's long-term memory. Recent experience of an error also increased its likelihood of being generated as an explanation.

Popper [1977, pp. 268–269] indicates that success in hypothesis generation is dependent on creativity—or what he describes as the critical imagination and the ability to vary the range over which hypotheses are generated. Elstein et al. [1978] confirm the need for this ability to generate a diverse set of hypotheses in their study of medical diagnosis. The ability to generate a diverse set of hypotheses consistently leads to a correct diagnosis being made. Analogical reasoning is a mechanism which enables the generation of a diverse set of hypotheses by using knowledge drawn from different domains [Einhorn and Hogarth, 1981]. Analogy thus maximizes the range, in terms of available knowledge, over which hypotheses are generated [Gick and Holyoak, 1983].

Analogical reasoning is a comparison of structure among complex systems. An analogy exists when the relations of two systems in different domains are the same, even though the objects of the systems are different [Gentner, 1982]. Sternberg [1977, p. 353] argues that we "reason analogically whenever we make a decision about something new in our experience by drawing a parallel to something old." The use of analogical reasoning can be seen in the interpretation of metaphor, the construction of new scientific models, the making of predictions and diagnoses, and in any situation that requires a novel problem solution [Gick and Holyoak, 1983].

The basis for the model of analogical reasoning described in this paper is the experimental work of Gick and Holyoak [1980; 1983]. They describe analogical problem solving as a five-step process:

1. The representation of the two analogs in memory—the source analog in long-term memory and the target problem in working memory.
2. Recognition of the potential analogical relation.
3. The initial mapping of the source analog to the target problem.
4. Extension of the mapping by constructing new knowledge about the target and thereby completing the analogy.
5. Testing of the target problem solution.

Gentner [1982] describes analogies as "structure mappings" where identical relations among different objects are mapped. This mapping process may, as Gick and Holyoak [1983] indicate, involve features of the analogs which are not explicit. The mapping process involves searching for a set of one to one correspondences based on the similarity of propositions (subschemata) at a specific level of abstraction. Completing most analogies involves searching for an alternate view of the source analog, where the object relations of the target analog are matched [Schon, 1979]. For hypothesis generation, the causal relations of the source analog are mapped to the target problem and a hypothesis is generated for the target problem based on this mapped structure.

The completion of the mapping between the two analogs results in the transfer of knowledge from the source analog to the target problem and the utilization of that knowledge in solving the problem. Thus, providing information relevant for hypothesis generation prior to the hypothesis generation task should lead to knowledge transfer and the generation of an analogous hypothesis. This generation of the analogous hypothesis should occur more often when a relevant analog is provided than when no relevant information is provided prior to the hypothesis generation task.

Hypothesis 1:

> Auditors will transfer knowledge to the target problem from the source analog to generate a hypothesis about an unexpected relation encountered during analytical review.

Analogical reasoning is needed to transfer knowledge from the familiar to the unfamiliar and to induce the regularities which form the basis of a schema. Both Holyoak [1982] and Novick [1988] argue that experts encode the structural or causal features of an analog, e.g., type of error such as omissions, whereas novices encode the detailed surface features of an analog. Experts are thus better able to recognize relations between problems which, on the surface, appear to be dissimilar. The ability of the expert to utilize the causal relations between problems is derived from their degree of experience in the specific domain. In auditing, this difference between experts and novices might be expected to apply to exceptions generated by analytical procedures in different transaction cycles. This difference enables experts to more readily notice and use analogies than do novices.

The novice auditor, on the other hand, may focus on surface features and use a procedure other than analogy. For example, means end analysis leads the novice auditor to analyze the data, identify the account(s) affected by the data, and then try to determine what debit/credit mechanism would be consistent with the observed effects (e.g., Kinney [1987]). The unusual fluctuations data provided by typical analytical procedures will generally not provide enough information to isolate one explanation using this debit/credit decomposition process. When relying on this process, novice auditors will thus be unsure as to which hypothesis is the most plausible.

Hypothesis 2:

> When generating a hypothesis, expert auditors will transfer knowledge from the source analog to the target problem more often than novice auditors.

The ability to reason analogically is a general reasoning mechanism that is highly correlated with intelligence [Sternberg, 1977]. While this ability will be correlated with performance in problem solving and judgment tasks there is no reason to expect that experience with or knowledge of analogy would be different for auditors and auditing students. To confirm this, Marchant [1987], in a series of experiments using the transfer paradigm to examine hypothesis generation in auditing, measured analogical reasoning ability with a test derived from the Millers Analogies Test. No significant difference was found between experienced auditors and auditing students in any of the experiments indicating that general analogical reasoning ability does not need to be controlled directly when examining the effect of audit experience on the use of analogy in audit judgment. The critical difference between subjects for hypothesis 2 is that different levels of experience in the audit domain will lead to differences in the use of analogy in tasks such as hypothesis generation using analytical procedures.

II. EXPERIMENTAL METHOD

Subjects

Subjects were 51 novice and 73 expert auditors. Experts were audit seniors from a single Big Eight accounting firm with experience ranging from 2.5 to 4.5 years with average experience of 3.13 years. Evidence provided by Abdolmohammadi and Wright [1987] indicates that audit seniors with this level of experience may be considered experts in the use of analytical procedures. Novices were undergraduate auditing students taking their second auditing class. These students were familiar with analytical procedures and their use in generating hypotheses explaining unusual fluctuations.

Procedure

Design. Subjects were randomly assigned to three experimental conditions. There were 26 experts and 18 novices in each of these experimental conditions.[1] The control condition contained only the target problem and was included to esti-

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[1] Out of the 124 booklets collected, five expert and three novice booklets were not used in the data analysis because they were incomplete.

EXHIBIT 1

EXPERIMENTAL TASK

Treatment	*Source Analog*	*Target Problem*	*Background*
Control	No source analog		
Timing	Asked to read and summarize a source analog which suggests that sales recorded in the wrong period is the solution to the target problem	Asked to read target problem, select two explanations, and identify the probability of the explanations given to subjects	Given background questions and requested to provide frequency estimates for the errors contained in a list provided to subjects
Performance	Asked to read and summarize a source analog which suggests that sales were recorded but the goods were never shipped is the solution to the target problem		

mate the effect of past specific instances and experiences that might influence the generation of an explanation. The two treatment conditions contained a source analog as well as the target problem. The source analogs for the two treatment conditions differed with respect to the solution (explanation) given for the source analog (timing or performance). This difference in potential explanation was intended to induce specific alternative solutions to the target problem. If varying the solution provided in the source analog leads to variation in the solution generated to the target problem then the argument that knowledge transfer from the source has occurred is strengthened. The two source analogs were selected so as to have very little surface relation to the target problem.

Task. The experiment was provided to the subjects in booklet form. For the experts, the experiment was conducted during a training session organized by their firm. For the novices, the experiment was conducted during the regularly scheduled class period. The general procedure, outlined in Exhibit 1, consists of the following five steps, which represent the different parts of the experimental materials:

1. Subjects in the "performance" condition were given a case to read with a potential explanation (solution), which was analogous to a specific solution of the target problem, and told that they would be tested on their understanding of this case. Subjects in the "timing" condition were given the same case to read with a different potential

explanation (solution), which was analogous to an alternative specific solution of the target problem, and also told that they would be tested on their understanding.

2. Subjects in both treatment conditions were asked to provide a case summary. This was done to ensure that subjects attended to the source analog.
3. Subjects in all three conditions were required to read the target problem and generate an explanation by selecting two likely potential explanations from a list provided to them. Subjects were required to generate two hypotheses since the hypothesis generation literature suggests that multiple hypotheses are typically generated in diagnostic tasks [Gettys and Fisher, 1979; Libby, 1985].
4. Subjects in all three conditions were required to identify the probability that each of the explanations provided in a list of potential explanations might be present in the target problem.
5. Subjects in all three conditions were given a post-experimental questionnaire designed to measure experience and beliefs.

Materials. Subjects in the two treatment conditions were provided with a case that served as the source analog. The source analog contained background information for a fictitious company, selected financial ratios for a four-year period, and an explanation for the unusual fluctuation contained in those as yet unaudited values of the ratios. The source analog, shown in Exhibit 2, differed between the two treatments only in the potential explanation suggested at the end of the case description. The explanation given in the "timing" condition is that "purchases were recorded in the wrong period." This explanation is analogous to errors for which transactions are recorded in the wrong period. The source analog for the "performance" condition differs from this in that the explanation in the "performance" condition is that "purchases were recorded but the goods were never received." This explanation is analogous to errors for which the transaction is recorded but never performed. These two explanations were chosen because their analogs in the sales transactions cycle are consistent with the same data fluctuation pattern but represent different error types. After providing a written summary of this source analog subjects were asked to analyze the target problem.

The target problem is contained in Exhibit 3. After reading the case the subjects were asked to complete three questions. These questions involved (1) selecting the two errors believed to be the best possible explanations from the list of eight explanations provided, (2) indicating the degree of confidence in the selections made for question 1, and (3) identifying the probability of occurrence for each of the eight explanations provided. The list of potential errors contained in these questions provided subjects with eight alternative sales errors, some of which were consistent with the case data, i.e., might explain the exception. There was, however, no one explanation that could be defended as the only "correct" explanation. The fifth explanation on the list, "sales recorded in the wrong period," is analogous to the explanation of the "timing" condition source analog that "purchases were recorded in the wrong period." The seventh explanation, "sales recorded but goods never shipped," is analogous to the source analog explanation of the "per-

EXHIBIT 2
SOURCE ANALOG CASE

The following information relates to the 1982 audit of International Chemical, Inc., a large manufacturer of various chemical agents used in pesticides and other household products. International Chemical, Inc., the largest consumer of sodium cyanamide (a material used in defoliants), operates in the United States and ten foreign countries. An error equivalent to one percent of sales is considered material for International Chemical, Inc. During the analytical review the following unusual fluctuations were discovered for 1982:

		BASE		*AUDIT*
	1979	*1980*	*1981*	*1982*
Materials Cost to COGS	0.40	0.31	0.35	0.50
Materials Usage Variance (hundred thousands)	78	90	85	150

At the request of the partner in charge of the audit you also examined the following relationships:

		BASE		*AUDIT*
	1979	*1980*	*1981*	*1982*
Units Purchased to Units Sold	0.6	0.67	0.70	0.99
Units Purchased (million gallons)	125	131	137	148
Sales (millions)	100	98	110	118

After additional substantive tests and examination of a sample of transactions, the partner in charge of the audit reported that the cause of the fluctuations was that (*in the timing condition*—purchases were being recorded in the wrong period)(*in the performance condition*—purchases were being recorded but the goods were never received).

formance" condition that "purchases were recorded but the goods were never received."

Dependent Variables. To measure knowledge transfer, two dependent measures were used. The first was the subject's response to the forced choice selection of hypotheses. The selected hypotheses were coded as 0 or 1 according to whether or not the selected hypothesis was analogous to the source analog. Since this dependent variable is binary, a log-linear analysis [Cox, 1970; Fienberg, 1980] was used to test for the effect of treatment and expertise on the selection of the analogous hypothesis.[2] This measure directly captures knowledge transfer, however, it also contains some noise since both experienced auditors and auditing students have knowledge such as base rates of error occurrence which may influence the forced choice task.

The second dependent measure is the subject's estimate of the probability of the two target errors contained in the list. The transfer of knowledge from the source analog would increase the information suggesting the analogous hypothesis thereby increasing the estimated

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[2] Subjects' assessments of their confidence in their selections of possible hypotheses are not included in the analysis since no significant treatment effects were obtained in the selection task or the confidence assessment.

EXHIBIT 3
TARGET PROBLEM CASE

You are engaged in the 1983 audit of MAC, Inc., a large manufacturing company located in southeastern Michigan. MAC, Inc. manufactures standard spark plugs and supplies them directly to automotive manufacturers and as spare parts to distributors. Manufacturing, sales, and administration all take place at MAC, Inc.'s large manufacturing and office complex in Monroe, Michigan. You have just completed a detailed analytical review of MAC, Inc.'s sales cycle and are in the process of completing a report of your findings for the partner in charge of this audit. An error equivalent to one percent of sales is considered material for MAC, Inc. During the analytical review you discovered the following unusual fluctuations for 1983:

		BASE		*AUDIT*
	1980	*1981*	*1982*	*1983*
COGS to Units Shipped	2.00	2.20	2.30	3.01
Actual Sales-Budget Sales (thousands)	300	200	250	700

At the request of the partner in charge of the audit you also looked at the following relationships:

		BASE		*AUDIT*
	1980	*1981*	*1982*	*1983*
Sales to Units Sold	3.10	3.30	3.35	2.80
Units Sold (thousands)	1000	1300	1800	2000

Before completing your report you must identify the potential error which could have led to these unusual fluctuations.

likelihood of occurrence of that hypothesis. This measure is more sensitive than the forced choice variable to the impact of knowledge transferred from the source analog on the likelihood of occurrence of the hypothesis. The probability estimate for each target error was analyzed in a 2×2 ANOVA with expertise and treatment as the two independent variables.

III. RESULTS

To test the hypotheses across the two dependent measures, the analysis was separated into two comparisons: control versus performance analog and control versus timing analog. The results for the forced choice task are presented first and then the results of the probability assessments are presented. Treatment and expertise are the independent variables for both analyses.

Forced Choice

The first hypothesis predicts that auditors who are given a source analog will transfer knowledge from the source analog to the target problem and are thus more likely to select the analogous hypothesis. This hypothesis leads to the prediction that subjects in the performance analog condition would choose the analogous hypothesis "sales recorded but goods never shipped" more often than subjects in the control condition. The number of subjects who either selected or did not select the analogous hypothesis across the control and per-

TABLE 1

NUMBER OF SUBJECTS SELECTING THE ANALOGOUS HYPOTHESIS OUT OF EIGHT POSSIBLE HYPOTHESES

Panel A. Comparison of Control to Performance Analog:

Subject Group	*Selection of Analogous Hypothesis*	*Source Analog*	
		Control	*Performance*
Expert	No	15	11
	Yes	10	15
	Total	25	26
Novice	No	7	6
	Yes	11	10
	Total	18	16

	Significance of Effects	
	χ^2	p
Expertise (*E*)	1.452	.228
Source Analog (*A*)	1.089	.297
$E \times A$	0.525	.469

Panel B. Comparison of Control to Timing Analog:

Subject Group	*Selection of Analogous Hypothesis*	*Source Analog*	
		Control	*Timing*
Expert	No	8	9
	Yes	17	13
	Total	25	22
Novice	No	13	10
	Yes	5	7
	Total	18	17

	Significance of Effects	
	χ^2	p
Expertise (*E*)	7.114	.008
Source Analog (*A*)	0.003	.954
$E \times A$	1.096	.295

formance analog conditions is shown in Table 1, panel A. For example, 15 of 26 experts and 10 of 16 novices chose the analogous hypothesis when provided with a source analog. As is indicated at the bottom of panel A, there was not a significant treatment effect ($p = .297$).

The first hypothesis also leads to the

prediction that subjects in the timing analog condition would choose the analogous hypothesis "sales recorded in the wrong period" more often than subjects in the control condition. The number of subjects who either selected or did not select the analogous hypothesis across the control and timing analog conditions is shown in Table 1, panel B. As is indicated at the bottom of panel B, providing a source analog did not significantly alter subjects' selection of the analogous hypothesis ($p = .954$). However, expertise was a significant effect ($p = .008$) with experts selecting the analogous hypothesis more often than novices across both the control and the timing analog conditions.

The second hypothesis predicts that expert auditors are more likely to select the analogous hypothesis than novice auditors when provided with a source analog. This hypothesis predicts an interaction between expertise and treatment. Table 1, panel A indicates that the expertise-treatment interaction was not significant when comparing the control condition to the performance analog condition ($p = .469$). The expertise-treatment interaction was also not significant (panel B) when comparing the control condition to the timing condition.

Probability Assessments

As indicated, subjects' probability estimates for the target error were analyzed using analysis of variance with expertise and treatment as the independent variables. The variance between cells was not homogeneous so that the arcsin transformation recommended for probabilities by Winer [1971, p. 400] was used to stabilize the variance. The first hypothesis predicts that the subjects' probability assessment for the analogous hypothesis will be greater in the source analog conditions than in the control condition or a significant main effect for the source analog (treatment) in the comparison between the control and the performance and timing conditions. The second hypothesis predicts that experts' probability assessments for the analogous hypothesis will be greater than novices' assessments when they are provided with a source analog or a significant interaction between expertise and treatment in both comparisons.

In the analysis of variance for the control versus performance analog conditions (Table 2) treatment was significant ($p < .05$). Expertise was also a significant main effect ($p < .05$). Within the performance analog condition, novices rated the probability of the analogous hypothesis higher than did experts. For both novices and experts, tests for the simple main effects indicate that the mean probability estimate of the target error in the performance analog condition was significantly greater ($p < .05$) than the mean probability for the target error in the control condition. In this comparison, hypothesis 1 was confirmed; auditors' probability assessments indicate that they did use analogical reasoning. However as Table 2 indicates, the interaction between expertise and source analog was not significant, so that hypothesis 2 is not supported in this comparison.

In the comparison between the control and timing analog conditions reported in Table 3, expertise was the only significant main effect ($p < .01$). The cell means, shown in Table 3, panel B, indicate that experts' probability estimates were greater across source analog groups than novices' estimates. In addition, for both experts and novices the mean probability estimate was larger in the source analog group than in the control group. Also for both experts and novices, the direction of the change in probability estimates across treatments was consistent with the hypotheses; however, the magnitude of the difference was not sig-

TABLE 2
ANALYSIS OF "PERFORMANCE" SOURCE ANALOG

Panel A. ANOVA with Probability Assessment of the Performance Error as the Dependent Variable:

Source of Variation	*Sum of Squares*	*df*	*Mean Square*	*F-statistic*
Expertise (*E*)	2.301	1	2.301	4.016*
Source Analog (*A*)	3.137	1	3.137	5.475*
E×*A*	0.187	1	0.187	0.327
Error	43.546	75	0.573	

Panel B. Cell Means (Standard Errors) for the Probability of the Performance Error:

	Source Analogs	
	Control	*Performance*
Expert	.210 (.053)	.319 (.065)
Novice	.262 (.044)	.500 (.089)

* Significant at the .05 level.

nificant and neither hypothesis is supported for this comparison.

IV. DISCUSSION

Why the difference between the performance analogy and the timing analogy? This difference in expert behavior between the two analogies may be attributed to the fact that the timing error is a much more frequently occurring error than the performance error [Coakley and Loebbecke, 1985]. The expert auditors' responses to a post-experiment question indicated that they believed that the timing error has a mean frequency of occurrence of 34 percent and the performance error has a mean frequency of occurrence of 18 percent. In a similar error detection task using the same cases, Marchant [1987] also found that experts believe that the timing error occurs nearly twice as frequently as the performance error. This difference in frequency of occurrence is confirmed by the data collected by Coakley and Loebbecke [1985, pp. 236–237], who found that the timing error is expected to occur in 14.9 percent of audits and the performance error is expected to occur in 7.6 percent of audits.

Libby [1985] found that experts' probability estimates for errors are based on their beliefs about frequency, and that experts are very accurate in their frequency estimates. He also found that experts tend to select errors that they believe occur frequently, over errors that they believe occur infrequently. The results of this study are consistent with these findings. Experts believed the timing error to be more likely than did novices (Table 3), but believed the performance error to be less likely than did novices (Table 2). This reflects the influence of the experts' knowledge about frequencies on their beliefs. Novices, in

TABLE 3
ANALYSIS OF THE "TIMING" SOURCE ANALOG

Panel A. ANOVA with Probability Assessment of the Timing Error as the Dependent Variable:

Source of Variation	*Sum of Squares*	*df*	*Mean Square*	F-*statistic*
Expertise (*E*)	3.632	1	3.632	8.776*
Source Analog (*A*)	0.235	1	0.235	0.567
E×*A*	0.232	1	0.232	0.561
Error	31.042	75	0.414	

Panel B. Cell Means (Standard Errors) for Probability of the Timing Error:

	Source Analogs	
	Control	*Timing*
Expert	.414 (.052)	.492 (.064)
Novice	.259 (.045)	.292 (.068)

* Significant at the .01 level.

the absence of knowledge about frequencies, believe the probability of occurrence to be approximately the same for the two errors (0.259 for timing and 0.262 for performance). Experts who believed the timing error to have a significantly higher frequency of occurrence than the performance error did not need to rely on analogy in generating the timing error. These results are consistent with the view that analogy is a useful strategy for the unusual situation. However, in a more frequent and familiar situation the auditor relies on specific knowledge based strategies.

The results of this experiment confirm the hypothesis that auditors will use analogical reasoning to generate a potential hypothesis in an unusual situation. Expert and novice auditors used analogical reasoning to generate a potential explanation to a seemingly unfamiliar situation. Contrary to expectations, experts did not differ significantly from novices in the use of analogical reasoning. For both experts and novices, analogical reasoning was the strategy selected for dealing with an unusual situation. When the situation was more familiar, strategies based on domain specific knowledge were used, rather than analogy, and a difference in performance between experts and novices was more apparent.

One explanation for these results is that with the development of expertise, the auditor is apparently led to depend upon knowledge based strategies, such as the feature matching model identified by Frederick and Libby [1986], that can be applied in familiar situations. As Libby [1985] indicates, the development of such strategies is based upon the expert's ability to accurately identify the frequency of occurrence of familiar errors. However, when the situation is unfamiliar, the results of this experiment indicate that the auditor relies on analogy rather than a knowledge based strategy to generate a potential error explanation.

Limitations

There is, given the design of this study, the possibility of a demand effect resulting from providing subjects with a single source analog. This might cause subjects to exhibit transfer because the experiment leads them to believe that this is what the experimenter expects. This does not seem likely in this case given the results using the infrequent source analog. Also, the generalizability of the results of this study may be limited since only one Big Eight accounting firm was used, although there is no evidence to suggest firm differences in the use of analogy in hypothesis generation. A question not addressed is the possibility of an interaction between auditing expertise and expertise at analogical reasoning. Experience with or training in the use of analogy might interact with the expert's knowledge of the auditing domain leading the auditor to make increased use of analogy in tasks such as hypothesis generation.

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Auditor Versus Model: Information Choice and Information Processing

Roger Simnett and Ken Trotman

ABSTRACT: This paper examines the comparative effect of information choice and information processing on the judgment performance of auditors over two different levels of environmental predictability. The task was the prediction of corporate failure. The study found that information choice, as evidenced through suboptimal selection of ratios, was a limiting factor in performance. However, although subjects were able to utilize all the information from the ratios they selected, they were unable to improve performance when supplied with the superior combination of ratios determined by the environmental model. Thus, information processing also became a limiting factor in performance when subjects were unable to choose their own ratios.

MORE than a decade has passed since Einhorn [1976] outlined some neglected issues in judgment research. Two of these issues which have received only limited attention in the accounting literature are the focus of this paper. First, Einhorn suggested that researchers in human information processing begin to incorporate information search and choice in their experimental designs. Second, he emphasized the importance of task effects on judgment/decision making.

The importance of examining information choice has since been supported in both the psychology and accounting literature (e.g., Abdel-khalik and El-Sheshai [1980], Einhorn and Hogarth [1981], Libby [1981], Trope and Bassok [1982], Kida [1984], and Lewis et al. [1988]). Einhorn and Hogarth [1981] emphasize that the process of information search and acquisition should be considered since evaluation and search strategies are interdependent.

One study in the accounting literature that allowed decision makers to choose the information cues they used in making their judgments was Abdel-khalik and El-Sheshai [1980]. The main purpose of their paper was to evaluate the relative contribution of the acts of information choice and information processing in decisions made by loan officers in predicting company default. They concluded that the subjects' choice of information, rather than their processing of

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the chosen cues, was the limiting factor in predicting the environmental event.

While the results of the Abdel-khalik and El-Sheshai [1980] study support the importance of information choice over weighting [Dawes and Corrigan, 1974], they appear to be inconsistent with some psychology and accounting research which suggests that humans are better at choosing rather than processing information. Dawes [1979, p. 573], in a discussion of the use of linear models, states:

> The linear model cannot replace the expert in deciding such things as "what to look for," but it is precisely this knowledge of what to look for in reaching the decision that is the special expertise people have. . . .

Similar conclusions have been arrived at in the accounting literature. Libby [1981, p. 104] states:

> The limited ability of people to integrate information from different sources appears to be the most consistent finding of the literature reviewed in this book. . . . While some experimental results may overstate the magnitude of this problem, Dawes' [1979, p. 573] and others' conclusion that "experts are much better at selecting and coding information than they are at integrating it" appears applicable to accountants and users of their information.

The second factor mentioned by Einhorn [1976] was the importance of the task. Einhorn notes that "while we may not know the *specific* effects of the task on judgment/decision making, most researchers now feel that the effects of the task are very important" [p. 199]. In fact there have been suggestions that proper sampling of tasks may be more important than proper sampling of individuals (e.g., Brunswik [1956] and Edwards [1972]).

The purpose of the present study is to further examine the comparative effect of information choice and information processing on the performance of users of accounting information over different levels of task complexity. The task is the prediction of corporate failure by auditors and is similar to the one used by Kida [1980]. This study is undertaken in Australia where there is a legal requirement for the Directors' Statement to include a comment that there are reasonable grounds to believe that the company will be able to pay its debts as and when they fall due. As this statement is covered by the audit report, the auditor is required to search for and process information in order to verify the assertions made by directors in addition to the usual going concern responsibilities. The dimension of task complexity manipulated was environmental predictability.

EXTENSIONS OF PRIOR RESEARCH

In examining information selection and information processing in their study of default prediction, Abdel-khalik and El-Sheshai [1980] developed a matrix of strategies for predicting the environmental event. The matrix consists of three different sources of prediction: human predictions made by the decision makers (HP), predictions based on "models of man" (MP), and predictions made by a mathematical model independent of the others. Each of these three types of prediction utilizes information cues chosen either by the mathematical model or by human decision makers. The resulting six combinations together with Abdel-khalik and El-Sheshai's results are shown in Table 1. As a result of a 90.6 percent hit rate for strategy S6 or MP_e/MS (e denotes environmental model), compared with 67.5 percent for strategy S3 or MP_e/HS (HS denotes human-selected information), and 62.5

TABLE 1

COMPARISON OF THE RESULTS OF THE STUDIES BY ABDEL-KHALIK AND EL-SHESHAI [1980] AND LEWIS ET AL. [1988][1]

Strategy	*Denoted*	*Evaluating the Predictive Ability of the Environmental Event*	*Abdel-khalik and El-Sheshai Study Percent of Correct Prediction*	*Lewis et al. Study Percent of Correct Prediction*
S1	HP/HS	The judge's validity (achievement index) using human-selected information.	0.625 (average)	0.45 (average)
S2	MP$_r$/HS	The validity of the "model of man" using human-selected information.	0.625[2] (average)	0.42 (average)
S3	MP$_e$/HS	Environmental mathematical model using information selected by humans.	0.675 (average)	0.45 (average)
S4	HP/MS	The judge's validity using model-selected information.	not studied	0.44 (average)
S5	MP$_r$/MS	The validity of the "model of man" using model-selected information.	not studied	0.44 (average)
S6	MP$_e$/MS	Environmental mathematical model using model-selected information.	0.906	0.60[3]

[1] Note that the two-way classification scheme of Abdel-khalik and El-Sheshai [1980] gives a probability of initial assignment to groups of 50 percent compared with 33.3 percent for the three-way classification of Lewis et al.

[2] Strategy S2 uses the linear model estimated from human responses and the information cues that they used to predict the environmental event. The model of man correctly predicted 84 percent of the responses of the judges. The 62.5 percent correct classification shown in the table is the percentage of correct prediction of the environmental event using the "model of man."

[3] The percentage of correct prediction fell to 41 percent on the validation model.

percent for strategy S1 (HP/HS), Abdel-khalik and El-Sheshai [1980] concluded that information choice was the major reason for the inferior prediction achievement. If this conclusion fully explains the inferior prediction we would expect strategy S4 or HP/MS (MS denotes model-selected information), which was not examined, to significantly outperform S1 and be close in performance to S6. Alternatively, if S4 does not outperform S1 it would suggest that either (1) the best linear model using model-selected variables was an overfit so that S6 was artificially high, or (2) humans have difficulty in combining information which they do not choose, leading to a lower accuracy for human judgments using model-selected data. For example, they may not have chosen a variable because they did not fully understand it or because they normally do not use that variable.

Lewis et al. [1988] extended the Abdel-khalik and El-Sheshai [1980] study by investigating the effects of information choice and information processing on the quality of municipal financial analysts' predictions concerning changes in the general obligation bond ratings of cities. Their results are also shown in Table 1. The authors included an S4 group but found performance of this group (0.44) to be similar to S1 (0.45) and inferior to S6 (0.60). To consider the possibility that the superiority of S6 was due to overfitting, they developed a validation sample. The performance of their statistical model (S6) dropped from .60 to only .41 on the validation model and the authors suggest there was some overfitting of their best statistical model due to the small number of cities in the original sample. They conclude that after adjusting for the situation specific advantage of statistical models, their results showed fairly even performance between models and man in selecting and processing data to predict bond rating changes.

On the basis of Lewis et al. [1988] it can be concluded that subjects given model-selected data (S4) do not perform any better than those given self-selected data (S1) and that the lower performance of S4 compared to the statistical model (S6) can in part be attributed to some overfitting of the statistical model. However, these conclusions are subject to a number of validity threats. First, the reason for S4 subjects not outperforming S1 subjects could be related to different motivation levels, with S4 subjects being less motivated than S1 subjects. In the first part of the experiment all subjects were asked to choose the five pieces of information that they believed would be most useful in predicting the bond rating changes. However, in the second part of the experiment, only S1 subjects received the ratios they chose. S4 subjects were given the model-selected ratios and not those they selected, which may have adversely affected their motivation and thus reduced the performance of S4. Some support for the differences in motivation is that subjects receiving self-selected data responded more often (54 percent) than did those receiving the model-selected data (32 percent). Second, it was necessary for the authors to use a surrogate validation sample, as their original sample exhausted the list of cities changing from A rating during the time period for which they had data. However, it appears that the task in the validation sample could have been quite different. That is, the validation sample had to distinguish between bond ratings of A1, A, or BAA, while the original sample was based on changes in ratings. If the changes were greater than the fine distinction between A and A1, it would be easier to classify the original sample, resulting in a lower accuracy rate for the validation sample.

The present study extends the research on information choice considered in Abdel-khalik and El-Sheshai [1980] and Lewis et al. [1988] in the following ways. First, we examine the full matrix of six possible combinations suggested by Abdel-khalik and El-Sheshai, on a similar prediction of failure task, in order to consider the validity of their conclusion that it is subjects' choice of information rather than their processing of the cues that limits performance. Second, we extend Lewis et al. by (1) dividing our original sample into two groups in order to have a validation sample rather than a "surrogate validation sample" to minimize the problem of possible overfitting; (2) attempting to avoid decreasing the motivation of S4 subjects by not asking them to select their preferred ratios before they performed the task with the ratios selected by the model; and (3) using a controlled administration of the experiment. Third, the effects of information choice and information processing are examined across different levels of environmental predictability, which is one dimension of task complexity. While task complexity is often varied in the psychology literature by manipulating the number of cues, Wood [1986] suggests that the strength of the relation between information cues and the objective criterion is an important aspect of complexity.

RESEARCH METHOD

Independent Variables

The task was the prediction of business failure using a set of financial ratios. The main task characteristic manipulated was whether subjects chose their own ratios or were given the ratios selected by an environmental model. The other characteristic manipulated was environmental predictability, which was operationalized by manipulating the number of years in advance of the event the prediction was made.[1]

Cases Used

The population of failed/non-failed firms for this study was comprised of the 103 corporations that were used in Izan [1984]. From this population, firms that had not been operating for at least three years and those in "extreme" industries were eliminated. "Extreme" industries were identified by reviewing industry average ratios and were eliminated in order to reduce the effect of industry specific information. The 63 remaining firms (30 failed, 33 non-failed) belonged to industry categories that could be broadly classed as "retail and manufacture." Of these, the 30 failed and 30 randomly selected non-failed firms were included in the study. These firms were randomly assigned to two samples of 15 failed, 15 non-failed firms. The first sample was used for developing the environmental model (model development sample), with the second sample being used to test the model's validity (validation sample). The subjects made their failed/non-failed predictions on this validation sample. Thus, Lewis et al. [1988] suggestion of comparing subjects' prediction achievement rates to the statistical models' validation sample hit rate was followed.

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[1] Izan [1984], in her analysis of failed firms in Australia, found that failure one year from the event was more predictable than two years from the event. The discriminant model correctly predicted failure/non-failure in 91.9 percent of situations using ratios one year from the event and 82.0 percent of situations using ratios two years from the event.

Development of the Environmental Model

Ten of the ratios from the Izan [1984] data base were used in the development of the model:

1. Earnings before Interest and Tax to Total Assets (EBTA)
2. Earnings after Interest and Tax to Total Assets (EATA)
3. Cash Flow before Tax to Financial Debt (CFFD)
4. Times Interest Earned (TIA)
5. Current Ratio (CR)
6. Quick Asset Ratio (QAR)
7. Market Value of Equity to Total Liabilities (MVTL)
8. Book Value of Equity to Market Value of Equity (BVMV)
9. Working Capital to Total Assets (WCTA)
10. Retained Earnings to Total Assets (RETA)

The other two ratios calculated by Izan [1984] were omitted because both the numerator and denominator could be negative for some firms, which would result in a positive ratio for these firms and a possible misleading indicator to subjects for a failed firm.

Discriminant analysis was used to develop separate environmental models for both one and two years prior to failure. The stepwise inclusion technique of minimizing Wilks' Lambda was used, and the discriminant model was allowed to select four discriminating variables.[2] The discriminant function ($\chi^2(4)=23.15$, $p<.0001$) for the model development sample one year prior to failure selected the following ratios: EATA, TIA, CR, and BVMV. The overall classification power of this model was 93.3 percent. The breakdown between failed and non-failed organizations is contained in Table 2 under the subheading Year One—Model Development Sample.

The correlation matrix for the model development sample is provided in Table 3 (panel A). There are high correlations between some of the ratios, especially EBTA and EATA (0.841), CR and WCTA (0.812), and CR and QAR (0.732). As the stepwise technique is not guaranteed to provide the "best" model, especially when there are high correlations between the variables, all possible combinations of four ratios were examined (210 combinations). No combination outperformed the model chosen although 24 of these combinations had equal performance. The predictive accuracy of these combinations ranged from 73.33 percent to 93.33 percent which indicates that there was scope for choice of ratios to have a significant effect. This was also supported by the substantial variation in predictive accuracy of the individual ratios as shown in Table 3 (panel A).

The discriminant function obtained from the model development sample was then tested on the validation sample for year one. The predictive power for the validation sample in year one using the weightings obtained from the model development sample was 93.3 percent, indicating no shrinkage. The breakdown between failed and non-failed organizations is included in Table 2 under the subheading Year One—Validation Sample.[3]

The correlation matrix for the valida-

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[2] Limiting cue choice to between two and four cues has been found to give optimal model performance, with additional variables resulting in statistically overfitted models and a decrease in cross-validation accuracy [Chalos and Pickard, 1985]. Performance of subjects has also been found to decrease if too many cues are required to be processed [Ogilvie and Schmitt, 1979]. In this task optimal environmental model performance was found to occur with the processing of four cues.

[3] The discriminant function derived directly from the year one validation sample correctly predicted 96.7 percent of the cases.

TABLE 2
OVERALL CLASSIFICATION POWER OF DISCRIMINANT FUNCTIONS

Model Development Sample ($n=30$)			*Validation Sample* ($n=30$)		
	Predicted Group Membership			*Predicted Group Membership*	
Actual Group Membership	*Failed*	*Non-Failed*	*Actual Group Membership*	*Failed*	*Non-Failed*
YEAR ONE					
Failed	13 (86.7%)	2 (13.3%)	Failed	14 (93.3%)	1 (6.7%)
Non-Failed	0 (0%)	15 (100%)	Non-Failed	1 (6.7%)	14 (93.3%)
Overall classification power: 93.3%			Overall classification power: 93.3%		
YEAR TWO					
Failed	11 (73.3%)	4 (26.7%)	Failed	10 (66.6%)	5 (33.3%)
Non-Failed	1 (6.7%)	14 (93.3%)	Non-Failed	1 (6.7%)	14 (93.3%)
Overall classification power: 83.3%			Overall classification power: 80%		

TABLE 3

POOLED WITHIN-GROUPS CORRELATION MATRICES

($n=30$)

Panel A. Model Development Sample—Year One:

	EBTA[1]	*EATA*	*CFFD*	*TIA*	*CR*	*QAR*	*MVTL*	*BVMV*	*WCTA*	*RETA*
EBTA	1.000									
EATA	0.841	1.000								
CFFD	0.252	0.174	1.000							
TIA	0.641	0.449	0.311	1.000						
CR	0.229	0.148	−0.190	0.145	1.000					
QAR	0.186	0.036	0.072	0.128	0.732	1.000				
MVTL	0.243	0.182	0.429	0.550	−0.007	−0.174	1.000			
BVMV	0.514	0.506	−0.049	0.104	0.410	0.364	−0.189	1.000		
WCTA	0.477	0.343	−0.106	0.243	0.812	0.475	−0.017	0.509	1.000	
RETA	0.656	0.714	0.047	0.319	0.305	0.117	0.082	0.294	0.615	1.000
Individual Predictive Ability Percent	76.7	66.7	56.7	86.7	73.3	70.0	70.0	56.7	80.0	76.7

TABLE 3—*Continued*

Panel B. Validation Sample—Year One:

	EBTA	*EATA*	*CFFD*	*TIA*	*CR*	*QAR*	*MVTL*	*BVMV*	*WCTA*	*RETA*
EBTA	1.000									
EATA	0.707	1.000								
CFFD	0.180	0.297	1.000							
TIA	0.612	0.455	0.473	1.000						
CR	0.036	0.018	0.073	0.069	1.000					
QAR	0.181	0.146	0.249	0.124	0.700	1.000				
MVTL	0.161	0.392	0.756	0.372	−0.232	0.093	1.000			
BVMV	0.028	−0.191	−0.051	0.106	0.162	0.199	−0.077	1.000		
WCTA	−0.007	0.035	−0.120	−0.054	0.891	0.642	−0.256	0.180	1.000	
RETA	0.397	0.308	0.118	0.406	0.507	0.301	−0.120	0.200	0.399	1.000
Individual Predictive Ability Percent	86.7	90.0	70.0	90.0	73.3	66.7	70.0	76.7	66.7	70.0

[1] EBTA = Earnings before Interest and Tax to Total Assets
EATA = Earnings after Interest and Tax to Total Assets
CFFD = Cash Flow before Tax to Financial Debt
TIA = Times Interest Earned
CR = Current Ratio
QAR = Quick Asset Ratio
MVTL = Market Value of Equity to Total Liabilities
BVMV = Book Value of Equity to Market Value of Equity
WCTA = Working Capital to Total Assets
RETA = Retained Earnings to Total Assets

tion sample is also included in Table 3 (panel B). High correlation was again found between the combinations of EBTA and EATA, CR and WCTA, and CR and QAR as well as between CFFD and MVTL. Also included in Table 3 (panel B) are the predictive abilities of the individual ratios. As with the model development sample there is again considerable variation. The main difference is that the predictive power of the earnings ratios are higher for the validation sample than for the model development sample. In order to maintain similarity between all task characteristics with the exception of predictive ability, the ratios that had been selected in year one by the environmental model were imposed upon the year two model development sample. The overall percentage of cases correctly classified on the year two model development sample was 83.3 percent. The breakdown between failed and non-failed organizations is included in Table 2 under the subheading Year Two—Model Development Sample. On applying the discriminant function derived from the year two model development sample (maintaining year one ratios) to the validation sample, the percentage of cases correctly classified was 80 percent. The breakdown between failed and non-failed organizations is included in Table 2 under the subheading Year Two—Validation Sample.[4]

Subjects, Procedure, and Task

The subjects in this study were 84 senior auditors drawn from six Big Eight accounting firms. The firms provided 14, 9, 20, 17, 8, and 16 subjects, respectively. Each subject had between three and six years experience.

Subjects were randomly assigned to one of four treatments (21 subjects per treatment). Subjects in treatments one and two (HS subjects) were asked to identify those four ratios out of the ten provided that they would like to be supplied with in order to distinguish between failed and non-failed firms. Those subjects in treatment one were provided with the ratios one year prior to possible failure and were asked "will this firm go bankrupt within one year?" on a Yes/No basis, and "what is the probability that your answer is correct?" on a six-point scale ranging from 0.5 to 1.0. The only change for treatment two subjects was that they were given the ratios they chose for two years prior to possible failure and were asked "will this firm go bankrupt within two years?" Subjects in treatments three and four (MS subjects) were provided with the four ratios selected by the model (EATA, TIA, CR, and BVMV). Treatment three subjects were given the ratios one year prior to possible failure, while treatment four subjects were given ratios two years prior to possible failure. For all treatments subjects were given written definitions of all relevant ratios that were not fully explained by their title. All subjects received the 30 cases comprising the validation sample. Subjects were told that the study used actual firm data and that the sample of 30 firms had been randomly selected from a population of an equal proportion of bankrupt/non-bankrupt firms. They were also informed that all firms were in the retail or manufacturing industries and had been in existence for at least three years. The experiment was administered in a controlled setting at the offices of each of the six accounting firms. Subjects in treatments one and two completed the experiment in a different room than subjects in treatments

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[4] The discriminant function derived directly from the year two validation sample correctly predicted 90 percent of the cases.

Table 4
Ratios Selected by HS Subjects (Treatments One and Two)
($n=21$ for each year)

	Number of Subjects Selecting Each Ratio	
	Year 1	*Year 2*
Earnings before Interest and Tax to Total Assets (EBTA)	3	7
Earnings after Interest and Tax to Total Assets (EATA)*	5	7
Cash Flow before tax to Financial Debt (CFFD)	15	13
Times Interest Earned (TIA)*	9	11
Current Ratio (CR)*	14	14
Quick Asset Ratio (QAR)	17	15
Market Value of Equity to Total Liabilities (MVTL)	10	7
Book Value of Equity to Market Value of Equity (BVMV)*	3	2
Working Capital to Total Assets (WCTA)	6	4
Retained Earnings to Total Assets (RETA)	2	4

* Ratios selected by model.

three and four. The reason for this was so the latter did not know that the former had the opportunity to select their own ratios. One of the researchers was in each of the two rooms. In addition, a research assistant was available to help with the HS subjects (treatments one and two) as it was necessary to provide them the ratios on an individual basis after each participant had selected their four ratios. To increase the efficiency of this process, envelopes containing each of the ten ratios were prepared in advance and the ratios selected could quickly be attached to the research instrument for each individual. Individuals were instructed to indicate whether they had been supplied with the requested ratios.

Results

Ratio Selection

The ratios selected by the subjects in years one and two are set out in Table 4. This table shows relatively high consistency in the selection pattern between the two years. On both occasions selection was dominated by the ratios CFFD, CR, and QAR, revealing that the subjects preferred information on cash flow and short-term financial position for making bankruptcy predictions. There was limited overlap between the ratios preferred by the subjects and those chosen by the model, with only CR (both years) and TIA (year two) being in the top four ratios chosen by both the subjects and the model.

The Effect of Complexity

The success rates using ratios one and two years prior to bankruptcy are contained in Table 5. It is not possible to do one ANOVA including environmental predictability (year), information choice, and information processing as the main effects because S6 consists of a single observation. Consequently, the following two separate analyses are made initially to test whether environmental predictability interacts with either choice or processing. Both a 2×2 ANOVA (information choice × environmental predict-

TABLE 5

SUCCESS RATES USING RATIOS ONE AND TWO YEARS PRIOR TO BANKRUPTCY

	Information Selection	
	By Subject (HS)	*By Model (MS)*
YEAR ONE		
Information Processing		
By Subject (HP)	81.1% (S1)	82.5% (S4)
By Model of Man (MP,)	78.4% (S2)	83.0% (S5)
By Model (MP,)	81.4% (S3)	93.3% (S6)
YEAR TWO		
Information Processing		
By Subject (HP)	74.0% (S1)	75.1% (S4)
By Model of Man (MP,)	72.7% (S2)	74.8% (S5)
By Model (MP,)	77.8% (S3)	80.0% (S6)

ability) for strategies S1 and S4 and a 2×2 ANOVA (information processing × environmental predictability) for strategies S1 and S3 were examined. Both sets of analyses show an environmental predictability effect (S1 and S4; $F(1)=16.94, p<.01$; S1 and S3: $F(1)=8.59, p<.01$) indicating as expected that subjects had lower performance using year two ratios than year one ratios. In addition the two sets of analyses show that this variable did not interact with either information choice ($F(1)=0.03, p=.86$) or cue processing ($F(1)=1.01, p=.32$). As the measure of task complexity used does not interact with information choice or processing, the remainder of the analysis aggregates across complexity where appropriate by combining the data from years one and two.

The Effect of Information Choice/ Information Processing

To examine the information choice/ information processing issue the following specific comparisons are made: S1 to S4, S3 to S6, S1 to S3, and S4 to S6.

The first comparison of S1 to S4 compares the performance of those subjects who select and process the information (HS) to those who are given model-selected ratios (MS) to process. That is, for both S1 and S4 the processing is done by the subjects, the difference being that for S1 the information selection is made by the subject while for S4 the information selection is done by the model. Given Abdel-khalik and El-Sheshai's [1980] conclusion that information choice was the major reason for the inferior predictive ability, it would be expected that S4 would outperform S1. In the 2×2 ANOVA (information choice × environmental predictability) outlined above, the main effect for information choice is not significant ($F(1)=0.38, p=.54$) indicating that there was no significant difference between subjects' ability to predict when they selected the ratios (S1) compared with their ability to predict when they were given model-selected ratios (S4). This suggests that (1) there was no increased information in the model-selected ratios, or (2) although there was additional information, subjects could not fully utilize the information content of the ratios selected by the model.

To consider the first of the above explanations, the next comparison was of S3 and S6. For both S3 and S6 the processing is done by the model (MP_e), the difference being that for S3 the information selection is done by the subjects whereas for S6 the selection is done by the model. As stated above, S6 is a single observation and no ANOVA is possible. Instead, S6 was subtracted from each value of S3 (across both years) and the resulting values were significantly different from zero ($t=-5.23$, $p<.001$). This shows that S6 outperformed S3 and there was additional information content in the model-selected ratios. This eliminates alternative (1) in the paragraph above as an explanation for S4 not outperforming S1.

To examine the second potential explanation for the failure of S4 to outperform S1 (namely that subjects could not fully utilize the information in the ratios selected by the model), S4 was compared to S6. For both S4 and S6 the ratio selection is done by the model (MS), the difference being that for S4 the information is processed by the subjects (HP) whereas for S6 the information is processed by the model (MP_e). To test this comparison, S6 was subtracted from each value of S4 and the resulting values were significantly different from zero ($t=-6.36$, $p<.001$). This shows that S6 outperformed S4 and that S4 subjects were unable to use all the information in the model-selected ratios.

The final comparison considers whether subjects are also unable to use all the information in the ratios they selected themselves. To consider this question S1 and S3 are compared. For both S1 and S3 the ratios were selected by the subjects (HS). The difference is that for S1 the information is processed by the subjects (HS) whereas for S3 the information is processed by the model (MP_e). In the 2×2 ANOVA (information processing × environmental predictability) the main effect for information processing was not significant ($F=1.20$, $p=.28$). The insignificant difference between S1 and S3 shows that when subjects selected their ratios, they were able to utilize all the information in the ratios.

The above four comparisons show that (1) subjects' choice of information is a limiting factor, and (2) while processing is not a limiting factor when subjects process the information which they selected, it does become a limiting factor when subjects are supplied with model-selected information.

Additional Analysis: Models of Man

There is conflicting evidence in the literature as to whether linear models of the decision-maker outperform the decision-maker on whom they are constructed (e.g., see Libby [1976a and 1976b], Goldberg [1976], and Dawes [1979]).

In Lewis et al. [1988] humans and their models had success rates of 45 percent and 42 percent, respectively, in the analyst-selected information condition, and success rates of 44 percent and 44 percent in the model-selected information condition. In the present study linear models of humans were developed for prediction one year and two years from bankruptcy and for information choice by both subject (S2) and environmental model (S5).[5] The average prediction rates for these models are shown in Table 5 and can be seen to be consistent with Lewis et al.

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[5] Before the models were developed the ratios were normalized in accordance with Goldberg's [1976] suggestion.

In the present study, when the results were aggregated across the four task categories, the subjects outperformed their model on 38 of 84 occasions, they were even on 20 occasions, and on 26 occasions the model outperformed the subject. While the results were in the same direction as Libby [1976a], matched-pairs *t*-tests ($t=1.11$, $p=.27$) revealed no significant differences between prediction by subjects and by linear models of man.

SUMMARY AND CONCLUSIONS

The aim of this study was to extend prior examinations of the comparative effect of information choice and information processing on judgment performance. Abdel-khalik and El-Sheshai [1980] concluded that information choice, rather than information processing was the limiting factor in performance. Consistent with this finding, we also found that sub-optimal selection of cues existed (S6 outperformed S3) and that when subjects selected their own cues there were no advantages in having the model process the information rather than the subjects (S1 equalled S3). However, we extended the Abdel-khalik and El-Sheshai study to consider the performance of subjects given the model-selected ratios (S4). The performance of S4 was not superior to S1 and was inferior to S6. These results are not consistent with the Abdel-khalik and El-Sheshai conclusion that information choice rather than information processing was the limiting factor in performance. Our results extend their study to show that while information processing was not a limiting factor when subjects chose their own ratios, it did become a limiting factor when subjects were given model-selected data. The question of whether these processing difficulties could be overcome by training subjects to become more familiar with the model-selected ratios, or providing feedback to subjects on their performance using these ratios, is not addressed.

Our results concerning the relative performance of S4 were consistent with the findings of Lewis et al. [1988]. However, on the basis of comparisons with a surrogate validation sample they suggest that the superior performance of S6 over other alternatives is due to model overfitting and conclude that there is neither a choice or processing effect. That is, they concluded that there is little difference in the performance of models and humans in selecting and processing data. In our study, we avoid overfitting by developing the model on one sample and applying it to a validation sample to examine human and model performance. We found superior performance of S6 and on the basis of the comparisons made conclude that (1) information choice was a limiting factor, and (2) while information processing was not a limiting factor when subjects chose their own ratios, it does become limiting when they are given model-selected ratios to process.

In conclusion, a number of limitations of the study are noted. First, subjects only chose four cues. As cognitive limitations in processing would be expected to increase as the number of cues increase, processing limitations may play a more important role in more complex situations. Second, only one aspect of task complexity, namely environmental predictability, was manipulated in this study. Wood [1986] outlines a number of other dimensions of task complexity, including the number of cues, that may provide greater insight into the choice versus processing of information issue. Third, the fact that different levels of environmental predictability did not affect the choice versus processing results may have been a consequence of the difference in environmental predictability between year one and year two data not being sufficient. A stronger manipulation of this variable could be achieved using an alternative task (e.g., prediction of management fraud) or by using data three or four years prior to failure.

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Accounting Method Choice in the Software Industry: Characteristics of Firms Electing Early Adoption of SFAS No. 86

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ABSTRACT: This paper extends accounting choice research to the software industry. Because firms in this previously unexplored industry are small, the research provides insight into determinants of accounting choices of small firms. Hypotheses about the effects of firm size and auditor preference on SFAS No. 86 adoption decisions are developed and tested. The results indicate that early adoption decisions are strongly associated with firms having small size and auditors who expressed support for SFAS No. 86 while it was in the exposure draft stage.

In November 1985 the Financial Accounting Standards Board issued SFAS No. 86, "Accounting for the Costs of Computer Software to be Sold, Leased or Otherwise Marketed." Under SFAS No. 86, capitalization and amortization are required for certain costs of developing software for sale. Most firms had been expensing these costs as incurred. Compliance with SFAS No. 86 was required for years beginning after December 31, 1985, with early adoption allowed. The early adoption option provided affected firms with an income-increasing accounting choice during the early adoption period. This paper develops and tests hypotheses about the characteristics of firms electing early adoption of the new accounting procedures compared to firms deferring adoption until the mandatory date.

Numerous studies have investigated the association between firm-specific variables and choices of accounting methods.[1] Hagerman and Zmijewski [1979], Zmijewski and Hagerman [1981], Bowen

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[1] Such studies are generally based on "positive accounting" or "economic consequences" theories (see Holthausen and Leftwich [1983] and Watts and Zimmerman [1986]).

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et al. [1981], Daley and Vigeland [1983], and Healy [1985] studied the effects of various factors such as size, risk, capital intensity, industry concentration, debt contracts, and bonus schemes on selection of accounting policies by management. The most consistent results have been found for size and for variables related to debt contracting. Ayres [1986] extended this line of work to the selection of adoption date of a mandatory accounting policy (SFAS No. 52) and found that early adoption decisions were most strongly associated with small size, low growth in earnings per share, and high dividend payout rates.

This study extends this branch of research to the issue of capitalization of software costs. Study of this issue may allow improved understanding of accounting choices for two reasons. First, focusing on firms in a single industry provides control for factors that affect firms differentially across industries. As discussed by Christie [1987], to the extent that omitted or unmeasurable variables are correlated with industry, use of a single industry sample will reduce specification error. Second, firms in the software industry are quite small, with even the largest firm in the sample collected for this study falling well below the *Fortune 500* minimum. The average firm in the sample used in the present study had annual sales of $58 million and total assets of $62 million. Use of this sample allows an opportunity to evaluate the robustness of the positive theory of accounting choice to smaller firms than have been previously studied.[2] There are several reasons to suspect that accounting choice processes of small firms and large firms may differ. For example, Atiase [1985] and others argue that information dissemination is less complete for smaller firms, since there are fewer analysts and institutional investors following small firms. Also, compensation arrangements for managers of small firms may differ from arrangements used by larger firms, and small firms are less likely to have public debt financing than large firms. These factors suggest that managers of small firms have different motivation than managers of large firms in selecting accounting policies. The results of this study show that the size effect persists even in a sample of small firms, suggesting that size reflects factors other than political costs.

The remainder of the paper is organized as follows: The provisions of SFAS No. 86 are described in Section I. Hypotheses are developed in Section II and sample data and univariate tests are described in Section III. Section IV presents multivariate tests of the hypotheses, and Section V concludes the paper.

I. Provisions of SFAS No. 86

Prior to SFAS No. 86, software development costs were accounted for in the same way as other research and development costs and were expensed as incurred as required by SFAS No. 2.[3] The new requirements imposed by SFAS No. 86 distinguish between costs incurred before and after "technological feasibility" has been established for the software product under development. While immediate expensing is retained for costs incurred before technological feasibility has been established, costs incurred subsequent to establishment of technological feasibility must be capitalized and amortized based on product revenue or over the estimated economic life of the product.[4]

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[2] Bowen et al. [1981] used a sample of firms with mean sales in excess of $1 billion. Ayres' [1986] study of early adopters of SFAS No. 52 was based on a sample of firms with total assets averaging over $3 billion. The sample of firms used in both Hagerman and Zmijewski [1979] and Zmijewski and Hagerman [1981] had average sales exceeding $1.7 billion.

[3] In Appendix A to SFAS No. 86, the 1983 imposition by the SEC of a moratorium on software capitalization is discussed. The moratorium allowed firms which were capitalizing software development costs at that time to continue to do so, while preventing firms not capitalizing from changing to a capitalization policy. The moratorium apparently resulted from adverse publicity about a few capitalizing firms, most notably Comserv Corporation. The capitalizing firms were a small minority, and none of the firms included in this study had capitalized software at the time of SFAS No. 86. As a result, the accounting choice faced by the firms included here was unambiguously income increasing.

Adoption of SFAS No. 86 was required for years beginning after December 31, 1985, with voluntary adoption for earlier periods. Since the statement was adopted in final form in November 1985, all affected firms had one year in which early adoption could be used to increase reported income.[5]

II. HYPOTHESES

Economic consequences theories of accounting choice predict that the firm's accounting policy decisions are related to its explicit and implicit contracting environment. The emphasis in this paper is on testing hypotheses related to size and to the role of the auditor in the accounting choice process. Economic factors that have been shown to influence accounting choice in previous studies, including employment relations, debt agreements, and insider ownership, will be treated as control variables.

Effect of Size on Accounting Choice

Watts and Zimmerman [1978] and other researchers have used firm size as a proxy for the political costs of the firm. Political costs include incremental taxes imposed on earnings and costs of political scrutiny and firm lobbying. To the extent that political costs are important and are associated with high accounting earnings, managers can be expected to elect income-reducing accounting alternatives. While results are mixed, it seems likely that political costs are an important factor for only the very largest firms. While firms in the software industry differ considerably in size, it seems unlikely that even the largest firms in the industry are large enough to incur political costs. Accordingly, political costs can be expected to play an unimportant role in accounting policy choices in this industry.

However, there are several other reasons to expect that accounting choice processes may differ in small and large firms. First, since small firms tend to be less diversified and generally riskier, managers of small firms seem likely to be more risk tolerant than managers of large firms. Thus, it seems likely that optimal risk-sharing compensation contracts for managers of small firms will include a higher proportion of incentive-based compensation, especially including options on firm stock. To the extent that such compensation is associated with accounting earnings, managers of smaller firms will have increased incentives to elect income-increasing accounting choices. Second, smaller firms are followed by fewer analysts and institutions than larger firms, suggesting that income-increasing accounting methods are less likely to receive wide public attention. Managers may believe that any benefits associated with higher accounting earnings are less likely to be dissipated by adverse publicity. Finally, smaller firms tend to have private debt contracts with banks rather than public debt, and bankers may actually prefer income increasing accounting methods in order to satisfy bank examiners and reduce required loan loss reserves. All of these factors suggest that even in the absence of political costs, a relation between size and accounting method choice may remain:

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[4] In general, technological feasibility requires completion of a detailed product design or a working model of the software. Subsequent capitalizable costs include costs of enhancements, packaging design, porting (modification for different operating systems), or production of product masters. Once the product is available for sale to customers, capitalization ceases and amortization begins.

[5] A few firms had two years in which early adoption could have been elected. Since SFAS No. 86 allowed adoption in financial statements not yet published, firms with October or November year-ends could have adopted in fiscal 1985, 1986, or 1987. All four of the firms in the sample with these year-ends were non-adopters, and were presumed to make an adoption decision at the October or November 1986 year-end. Federal income tax accounting rules for these costs were unchanged. Accordingly, early adopters did not forego any tax deductions and tax considerations can be ignored for purposes of this study.

H1: Firms electing early adoption of SFAS No. 86 are smaller than firms not electing early adoption.

Auditor Effects

The usual economic consequences hypotheses presume a rational decision-making manager making accounting choice decisions to optimize economic consequences of the choice. But what factors influence a choice when there are no overt economic consequences, as might be the case when there are no management compensation plans or debt agreements? One explanation for observed accounting choices in such an instance is the possibility that when managers are essentially indifferent to an accounting choice the preferences of other participants in the financial reporting process become important factors in the decision.[6] If the firm's auditor, for example, has a strong preference regarding the choice, the manager may acquiesce in the auditor's choice. If different auditors recommend different adoption strategies for their clients, observed differences in accounting choices might be explained. Such a role for the auditor might be more pronounced in the software industry because small firms have less sophisticated financial management and may look to their auditors for advice about implementation of new accounting standards. The following hypothesis is based on this line of reasoning:

H2: Early-adopting firms are clients of auditors with a stated preference for software capitalization.

For purposes of testing this hypothesis, the preferences of auditors were determined by reviewing letters of comment received by the FASB during the exposure draft period. All of the Big Eight accounting firms and a number of smaller national and regional CPA firms submitted letters of comment on this subject.

Control Variables

In order to examine the two hypotheses above, it is necessary to control for factors known to be related to accounting choice decisions. The most commonly tested factors in the positive accounting theory literature are related to compensation and debt contracting, and to insider ownership.

Management is expected to have a pecuniary interest in the level of reported earnings even in the absence of explicit earnings-based bonus plans. By improving reported firm performance over time, managers can justify requests for increased compensation as either increased salary or increased incentive compensation such as bonuses or stock options. The manager is considered to have an employment contract, even in the absence of a formal employment agreement, which rewards higher levels of reported earnings. While this factor is expected to influence decisions of all

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[5] The preferences of these other participants would presumably be economically motivated as well. Auditors, for example, may take public positions in order to enhance their reputation as "aggressive" or "conservative," or to create a reputation as professional leaders.

managers, its effect can be expected to be more significant for firms with marginal (as opposed to extremely poor or extremely good) performance. Further, managers can be expected to be concerned with possible termination resulting from extremely poor performance. Accordingly, the manager will attempt to avoid reporting earnings which are below the level of the prior year, and if such a decrease must be reported will attempt to mitigate it to the extent possible. This line of reasoning is consistent with evidence cited by Ayres [1986] that management incentive compensation is strongly related to profitability. The control variable, an indicator for decline in pre-adoption earnings compared to the prior year, is predicted to be positively related to early adoption.

It should be noted that use of this control variable is necessary only if the directors administering compensation plans will not adjust the plans for changes in accounting methods. Watts and Zimmerman [1978] suggest that the costs of adjusting bonus plans are so small that little relation should be expected between the existence of such plans and accounting method choices. A similar argument can be made with respect to compensation arrangements in general. If directors can costlessly "unravel" the manager's accounting method choices and this fact is known to management, accounting choices should be unrelated to management compensation. However, there may be a lag between an accounting change and adjustment of compensation contracts, so that accounting manipulations may have at least a short-run benefit to managers.

A second control variable deals with the effect of debt contracting on accounting choice. Debt agreements typically include covenants restricting the levels of financial statement parameters measuring factors such as leverage, profitability, and liquidity. The decision to elect early adoption of SFAS No. 86 increases income and decreases leverage. To the extent firms are constrained by covenants pertaining to leverage and profitability, management is expected to select income-increasing accounting methods in order to reduce the probability of covenant violations and avoid the possible costs of renegotiation of debt agreements. This debt contracting argument leads to inclusion of a control variable which represents long-term leverage for firms with debt agreements and is zero for other firms, and which is predicted to be positively related to early adoption. By using leverage as a control variable, it is implicitly assumed that the cost of covenant violations increases with the amount of debt outstanding.

Dhaliwal et al. [1982] and Ayres [1986] find that, *ceteris paribus*, firms with large insider ownership are less likely to adopt income-increasing accounting choices. The economic argument for this finding is that high insider ownership reduces the importance of accounting numbers in compensation contracting, reducing manager incentives to manipulate reported earnings. Accordingly, the percentage of insider ownership by officers and directors is included as a third control variable.

III. DATA AND UNIVARIATE TESTS

Software firms were identified using Standard & Poor's Register of Corporations, Directors and Executives. Individual company descriptions were examined for each of 481 firms listed in the index under SIC code 7372, "Computer Programming and Other Software Services." Of these 481 firms, 359 were eliminated either because the company description indicated that sales of computer software was not a major business of the company or because the company

TABLE 1

DESCRIPTIVE STATISTICS FOR SAMPLE SOFTWARE FIRMS
FISCAL 1986 FINANCIAL STATEMENTS

	*Adopt**	n	*Minimum*	*Maximum*	*Mean*	*Median*	*Standard Deviation*
Sales	0	39	$ 945	$312,207	$64,763	$29,530	$71,962
(000)	1	14	$ 812	$278,871	$41,756	$13,069	$75,084
R&D Expense	0	39	$ 550	$126,845	$13,727	$ 6,902	$21,141
(000)	1	14	$ 157	$ 29,177	$ 6,503	$ 1,432	$10,088
Pretax Income	0	39	($6,852)	$ 74,332	$12,068	$ 5,409	$19,086
(000)	1	14	($9,277)	$ 12,827	$ 823	($277)	$ 5,793
R&D/IBT	0	39	11.0%	6820%	415%	93%	199%
	1	14	23.0%	2451%	435%	91%	301%
Debt/Equity	0	39	0.0%	386%	62%	39%	76%
	1	14	0.0%	444%	102%	55%	123%
Debt/Assets	0	39	0.0%	31.6%	2.9%	0.5%	5.8%
	1	14	0.0%	39.3%	13.9%	6.0%	14.9%
Total Assets	0	39	$ 417	$251,906	$69,386	$35,118	$74,022
(000)	1	14	$ 375	$182,718	$42,371	$13,000	$63,013

* 1=adopters, 0=non-adopters.

was privately held. Financial statements (10-K or annual report) and proxy statements were requested directly from the 122 remaining companies. Of the 102 companies responding,[7] 49 were eliminated because computer software did not constitute a major line of business or because of various data deficiencies. Of the 53 remaining companies, 14 elected early adoption of SFAS No. 86 and 39 did not elect early adoption. Descriptive statistics for the sample firms are included in Table 1, and variable definitions are in Table 2.

Table 2 presents univariate tests of differences in means for the variables of interest. The difference in means between the two groups is significant at the .05 level or better for the variables SIZE, AUDITR, IBTDN, and DEBT.[8] The results for SIZE are consistent with the hypothesis that small firms and large firms have different motivations even in the absence of political costs.

The results for AUDITR are consistent with the notion that a firm's auditor plays some part in the accounting choice process. Table 3 includes a tabulation of adoption category by auditor and is a useful supplement to the comparison of group means. There is a strong suggestion of differences in the auditor breakdown of the two groups (one Big Eight auditor serving almost half of the adopting firms and three Big Eight firms serving none). The χ^2 statistic for a test of independence of auditor and adoption status is 13.7 with eight degrees of freedom, which is significant at better than ten percent.

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[7] A number of the nonresponding companies were later determined to have moved with no forwarding address, raising the possibility that they had failed and that the sample used here is biased in favor of surviving companies. This is probably a minor problem because of the short elapsed time between the end of the early adoption period and the commencement of this study.

[8] An approximate randomization approach [Noreen, 1989] was also used, as well as a nonparametric Mann-Whitney *U*-test. Each produced significance levels similar to those based on the *t*-statistics presented in the tables.

TABLE 2

UNIVARIATE TESTS OF THE ASSOCIATION BETWEEN EXPLANATORY VARIABLES AND EARLY ADOPTION OF SFAS NO. 86
($n=53$)

			Group Means			
Hypothesis	*Variable*†	*Predicted Result*	*Adopters (A)*	*Non-Adopters (NA)*	t-*statistic**	p-*value**
H1	SIZE	(A)<(NA)	9.292	10.464	−2.21	0.021
H2	AUDITR	(A)>(NA)	0.928	0.615	2.94	0.002
	IBTDN	(A)>(NA)	0.643	0.179	3.16	0.002
	DEBT	(A)>(NA)	0.114	0.026	2.40	0.015
	OWNSHP	(A)<(NA)	0.362	0.366	−0.08	0.468

* The t-statistics shown are for the differences in means between the two groups. The p-values shown are for one-tailed test versus the null hypothesis.

† Definition of variables:

ADOPT = Indicator variable for SFAS No. 86 adoption status (1 = early adopter, 0 = adoption deferred),
DEBT = A debt variable equal to the ratio of long-term debt to total assets for firms with debt having restrictive covenants and equal to zero for other firms,
IBTDN = Indicator variable for change in earnings from the prior year (1 = decrease in earnings or increase in loss, 0 = increase in earnings or decrease in loss),
SIZE = Natural logarithm of net sales,
OWNSHP = Percentage of ownership by officers and directors as a group, and
AUDITR = Indicator variable for preference of firm auditor (1 = preference for capitalization expressed in comment letter to FASB, 0 = preference for expensing expressed in comment letter).

TABLE 3

ANALYSIS OF ADOPTION GROUPS BY AUDITOR BASED ON LOBBYING LETTERS SUBMITTED TO FASB ON SFAS NO. 86

		Clients' Adoption Decision		
Auditor	*Auditor Lobbying Position*	*Adopting*	*Non-Adopting*	*Adopting Percentage*
Coopers & Lybrand	For	6	3	66.7%
Touche Ross	For	1	1	50.0
Price Waterhouse	For	2	6	25.0
Peat Marwick Main	Against	2	6	25.0
Arthur Young	For	2	9	18.2
Arthur Andersen	For		4	0.0
Ernst & Whinney	Against		6	0.0
Deloitte Haskins & Sells	Against		3	0.0
Non-Big Eight		1	1	50.0
		14	39	

The results for the control variables DEBT and IBTDN are consistent with results in a number of prior studies (e.g., Daley and Vigeland [1983]; Bowen et al. [1981]; and Ayres [1986]). While OWNSHP is not significantly different be-

TABLE 4
CORRELATION AMONG EXPLANATORY VARIABLES
($n=53$)

Variable	*OWNSHP*	*DEBT*	*IBTDN*	*SIZE*	*AUDITR*
OWNSHP	1.000	0.263*	0.031	−0.337**	−0.209
DEBT		1.000	0.241	0.138	−0.139
IBTDN			1.000	0.042	0.099
SIZE				1.000	−0.013
AUDITR					1.000
R^2†	0.152	0.135	0.081	0.074	0.026

* Significant at .05 level (two-tailed test).
** Significant at .01 level (two-tailed test).
† The R^2 is the coefficient of multiple determination based on a regression with all other explanatory variables as independent variables.

tween the groups, this may be due partly to high correlation with SIZE, as can be seen from Table 4.[9]

IV. MULTIVARIATE TESTS

Three alternative models (probit, logit, and OLS) were used to test the combined predictive power of the explanatory variables. Noreen [1988] demonstrated empirically that OLS regression is superior to probit and logit in research involving small samples, as in this paper. Since the three models produced very similar results, only the OLS results will be discussed.

The results presented in Table 5 are generally consistent with the univariate tests in that SIZE, DEBT, IBTDN, and AUDITR are the most powerful explanatory variables. While the coefficient for SIZE is less significant than in the univariate test, suggesting that the multicollinearity noted earlier does overstate the significance of SIZE, it is still quite large and in the hypothesized direction.

The AUDITR variable seems quite important in the adoption decision and is a new result in the accounting choice literature. However, in addition to the possibility that the auditor preference hypothesis is true, the result could be interpreted as evidence that certain auditors seek or attract clients with the attributes which happen to motivate early adoption decisions. Alternatively, it is possible that auditor lobbying positions are determined based on client preferences. In order to evaluate these possibilities, the characteristics of firms grouped based on auditor lobbying position were examined in Table 6. The only significant difference between firms with auditors lobbying against the exposure draft and firms lobbying in favor of the exposure draft is the subsequent adoption decisions of the firms. This suggests that auditor preferences are influencing client decisions rather than client preferences dictating audit firm lobbying positions. Further, SIZE for firms whose adoption decisions differed from their auditors'

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[9] Another possibility is that because firms in this industry are small, there is a high level of inside ownership across the industry. This is evident from Table 2, which shows average inside ownership of over 36 percent for both groups, much higher than in most studies of this type.

TABLE 5

OLS MODEL OF THE RELATION BETWEEN EXPLANATORY VARIABLES AND EARLY ADOPTION OF SFAS NO. 86

$$\text{ADOPT} = b_0 + b_1\text{SIZE} + b_2\text{AUDITR} + b_3\text{IBTDN} + b_4\text{DEBT} + b_5\text{OWNSHP}$$

$(n = 53)$

Hypothesis	*Variable*	*Expected Sign*	*Coefficient*	*Standard Error*	t-*statistic*
	Constant		1.086	0.671	1.619
H1	SIZE	(−)	−0.069	0.034	−2.008*
H2	AUDITR	(+)	0.287	0.108	2.657*
	IBTDN	(+)	0.201	0.106	1.888*
	DEBT	(+)	1.998	0.565	3.539*
	OWNSHP	(−)	−0.386	0.289	−1.332
	Adjusted $R^2 = 0.396$*				

* Significant at .05 or better based on one-tailed test with 47 degrees of freedom. Note that since the dependent variable in the regression is dichotomous, the distribution of the residuals does not approximate normal, and the use of t-statistics may be questionable. To test the effect of this problem, an approximate randomization test was used as described in Noreen [1989]. The randomization test consists of generating an empirical distribution of coefficients under the null and comparing the observed coefficients to the empirical distribution of coefficients. This procedure resulted in significance levels quite close to those obtained using the t-statistics.

TABLE 6

UNIVARIATE TESTS OF THE ASSOCIATION BETWEEN EXPLANATORY VARIABLES AND AUDITOR LOBBYING POSITION ON SFAS NO. 86

$(n = 53)$

Variable	*Auditor In Favor*	*Auditor Opposed*	t-*statistic for Difference in Means*	p-*value (two-tailed test)*
SIZE	11.060	10.751	0.91	0.371
ADOPT	0.351	0.063	2.85	0.006
IBTDN	0.324	0.250	0.55	0.590
DEBT	0.069	0.055	0.45	0.653
OWNSHP	0.338	0.422	−1.38	0.180

lobbying positions was significantly larger ($t = 2.11$) than for firms whose adoption decisions agreed with auditor lobbying position. It is clear that the possibility that auditor preferences may play an important part in the accounting choice process, especially for small firms, cannot be dismissed.

V. CONCLUSION

This study investigated the determinants of decisions by firms in the software industry to adopt or delay adoption of SFAS No. 86. The hypotheses that the adoption decision was related to firm size and to auditor preference were strongly supported by the analysis. Variables included to control for the firms' compensation and debt contracting environment were also significant explanatory factors.

The results for the variable SIZE can be interpreted as providing indirect evidence about the effects of political costs on accounting choice. While software industry firms vary significantly in size, it seems unlikely that political costs would be significant even for the largest firms in the industry. Accordingly, if political costs are driving the results for size found in previous studies, no significant difference in SIZE would be expected between SFAS No. 86 adopting and non-adopting firms. However, the observed results indicate that a size effect is present even in the absence of differential political costs. This suggests that size is related to firm attributes other than political costs, such as differences in compensation structure or perceived differences in information dissemination.

The apparent effect of a firm's auditors on the accounting choice process is subject to ambiguous interpretation, as discussed earlier, but the evidence is not inconsistent with auditors exerting some influence in client firms' accounting policy decisions.

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SMALL SAMPLE STUDIES

M. Edgar Barrett, Editor

The Achievability of Budget Targets in Profit Centers: A Field Study

Kenneth A. Merchant and Jean-François Manzoni

ABSTRACT: This paper reports the findings of a field study aimed at providing a better understanding of how and why managers of corporations with multiple divisions set the levels of achievability of annual profit center budget targets. The data, gathered from 54 profit centers in 12 corporations, show that most budget targets are set to be achievable an average of eight or nine years out of ten. This finding contrasts with the prescription made in most management accounting textbooks suggesting that for optimum motivation budget targets should be achievable less than 50 percent of the time. Managers maintain, however, that these highly achievable targets provide considerable challenge, and the high achievability actually provides many advantages, including improved corporate reporting, resource planning, control, and, combined with other control system elements, even motivation.

MOST textbooks and articles on budgeting suggest that for maximum motivation budget targets should be "tight, but achievable." Although agreement as to how to operationalize this phrase does not exist, most authors (e.g., Horngren and Foster [1987], Horngren and Sundem [1987], Otley [1987], Hopwood [1974], Shillinglaw [1982], and Dunbar [1971]) describe the probability of achievement of tight but achievable goals as less than 50 percent.[1] For example, Dunbar [1971] concluded that budget targets should be set so that they are achievable between 25 percent and 40 percent of the time, and Otley [1987, pp. 44–45] notes that, "The budget level which motivates the best performance is one that is somewhat more demanding than the level of performance that will actually be achieved."

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[1] Anthony et al. [1985] and Welsch et al. [1988] are in the minority in recommending the probability of achievement as 50 percent or even higher.

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In the early stages of a field study focused broadly on control of profit centers (PCs) in corporations with multiple divisions, we observed that the typical level of profit center budget achievability was considerably higher than 50 percent. We found that corporate managers espouse a "tight but achievable" budgeting philosophy, but they implement it so that profit center managers *expect to* and *actually do* achieve their budget targets almost every year. This apparent conflict with predominant textbook theory suggested the need for further exploration of the issue.

This paper describes the study, reports data on the achievability of budget targets in 54 PCs in 12 corporations, and examines the rationales underlying managers' budget target choices. It describes the differences between theory and practice and discusses the causes of these differences.

BACKGROUND

Textbook prescriptions to set budget targets with less than a 50 percent chance of achievement are supported by evidence provided in the psychology literature showing a negative relation between target achievability and performance. That is, less achievable (more challenging) performance targets lead to higher motivation and performance.[2] For example, in a review of more than 100 laboratory and field experiments in the psychology literature, Locke et al. [1981, p. 131] conclude that the consistent finding is that "specific hard goals [induce] better performance than do-your-best or no goals." They also conclude that "the beneficial effect of goal setting on task performance is one of the most robust and replicable findings in the psychological literature" [p. 145]. Similarly, Latham and Lee [1986, p. 105] concur that "the results are overwhelming in both laboratory and field settings."

Most experimental studies published in the accounting literature also show that less achievable targets lead to higher performance [Stedry, 1960; Stedry and Kay, 1966; Rockness, 1977; and Chow, 1983]. In Stedry and Kay's [1966] field experiment, for example, less achievable goals (previously attained only 25 percent of the time) led to good performance when the subjects perceived the goals as challenging and raised their "level of aspiration" to try to achieve them. Their findings, however, also point to one of the limits to the generalizability of the achievability/performance relationship: Less achievable goals led to poor performance when the subjects were not committed to achieve the goals because they perceived them as unattainable. This commitment constraint has been repeatedly replicated (see Locke et al. [1988] for a review). Evidence also exists, however, that other contextual factors (e.g., incentives) can correct or compensate for a lack of commitment, but to date "not enough is known about the relative importance of the various determinants of goal commitment to permit meaningful predictions of their effects on commitment when there are conflicting elements" [Locke et al., 1988, p. 34].

Other contextual limits on the achievability/performance relation have also been shown or suggested. Garland [1984] concluded that the relation is more likely to hold in experimental settings characterized by tasks of relatively short duration, where ability does not account for most of the performance variance, and where feedback is immediate but no external rewards are provided. Huber [1985] found that the achievability/performance relation reversed in a setting characterized by uncertainty and complexity. Hollenbeck and Klein [1987] suggested that goal commitment is low under conditions where exogenous factors exert a high influence on the outcome because failure to achieve the goal can be easily attributed to those factors. Finally, Chow [1983] and Mowen et al. [1981] suggest that the relation between achievability and performance is contingent on the financial incentives associated with performance; they report a negative relation under a piece-rate pay plan but not under an all-or-nothing bonus system.

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[2] In this paper, we refer to the achievability of budget targets, whereas most prior research refers to the difficulty of budget targets or goals. In laboratory or field experiments, the notion of difficulty is usually operationalized by using an objective probability of achievement (e.g., how often a particular objective is achieved in a trial run). Given this operationalization of difficulty, the concepts of achievability and difficulty are exact opposites. The term "achievability" is used here because it best expresses the preoccupations of the managers (corporate as well as profit center) interviewed.

These findings are significant because PC managers typically operate under conditions of high uncertainty and high complexity, and their performance measures *are* affected by many exogenous factors.[3] They also face reward systems with both piece-rate and all-or-nothing characteristics. Thus, it must be concluded that the research literature does not support any clear prescription for budget target-setting in profit centers except to avoid targets that lose their motivational appeal because the managers perceive them as unattainable.

No specific evidence exists about the actual levels of budget target achievability at PC levels within corporations. Most field-based studies of budget targets (e.g., Otley [1985], Cress and Pettijohn [1985], Kenis [1979], and Hofstede [1968]) have focused on cost center managers and measured achievability using ambiguous verbal scales.[4] For example, Umapathy [1987] reported the following distribution of budget targets from a survey of 402 firms in a variety of manufacturing and service industries:[5]

Descriptor	*n*	(%)
Almost impossible	28	(7)
Challenging	201	(52)
Slightly beyond our reach	72	(19)
Just right	64	(16)
Relatively easy	24	(6)

These data appear to show that budget targets are on the challenging side of a "best guess," but the achievability levels are not specific and the ordering of the verbal scale may be unreliable as it implies that "challenging" is less achievable than "slightly beyond our reach." These meanings differ from those attached to the terms by the managers we interviewed, many of whom described their budgets as challenging even though they were confident they would achieve them.

Verbal-scale, field-based studies have consistently shown that considerable variation exists in the levels of budget-target achievability, but only a small amount of evidence exists to explain this variation. Simons [1988] found budget tightness to be positively associated with the use of monitoring and reporting controls and formula-based remuneration. He also reported a relation between strategy and budget-target achievability: budget targets of "defenders" were on average more achievable than those of "prospectors." Several studies [Lukka, 1988; Merchant, 1985a; and Onsi, 1973] found uncertainty, information asymmetry, and profitability to be positively associated with the creation of budgetary slack which, in turn, was related to budget-target achievability.

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[3] Hirst [1987] developed a theoretical argument suggesting that budget achievability should be high (low) where budget targets are important and task uncertainty is high (low).

[4] PC budgets may be quite different from cost center budgets for any of the following reasons. (1) PC managers are not as buffered from the external environment as are cost center managers (particularly those in production areas). The resulting higher uncertainty in planning may lead them, for example, to incorporate more slack in their budgets. (2) PC managers can make more tradeoffs (e.g., reducing price to make a sale, cutting advertising to boost current period income) to achieve their budget targets. This additional flexibility may mean that profit targets are achievable even if some portions of the budget forecast (e.g., revenue) are inaccurate. (3) PC managers are more likely to experience a direct link between reaching budget targets and receiving significant rewards linked directly to budget accomplishment. For these managers, therefore, the stakes are higher. Risk aversion may lead them toward defensive routines, such as the creation of budgetary slack.

[5] Only 389 firms responded to this question.

Several theoretical papers add still another complication that may occur. These papers [Barrett and Fraser, 1977; Hopwood, 1974; and Stedry, 1960] point out that no one single target can serve all budget purposes (e.g., planning, motivating, evaluating) optimally. The authors suggest that for motivational purposes the target should be challenging, whereas for planning purposes, budgets are most useful if they "reflect management's best estimates of revenues and expenses . . . what is most probable" [Barrett and Fraser, 1977, p. 141].

As one possible solution to the conflicts among budget purposes, Hopwood notes the possibility of a "bottom drawer phenomenon" in which upper-level managers use budgets for motivational purposes while keeping another, realistic set of numbers for planning and decision making purposes in the bottom drawer of their desks. Otley [1982] speculated that most firms use one form or another of this method. But Umapathy's [1987] survey found that only seven percent of corporations actually use more than one budget. This finding suggests that firms make compromises in the uses of their budgets, that they have other ways of solving the conflict between motivation and planning, or that the survey respondents were not aware of the alternate budgets some managers may have had in their desk drawers.

RESEARCH METHOD

Three research questions were used to guide the exploration of budget-achievability issues. The first is suggested by the theoretical writings describing the advantages of having multiple budget targets to serve multiple budget purposes:

Research Question 1:

> Do PCs have multiple budget targets?

The second question asks whether the finding showing budget targets as slightly more challenging than a best guess, on average, can be generalized to PC organization levels.

Research Question 2:

> How achievable are PC budget targets?

The third motivates an exploration of managers' rationales for choosing their level(s) of budget-target achievability.

Research Question 3:

> Why are PC budget targets set at the level(s) they are?

Sample Selection

The study was conducted in a diverse set of 12 corporations to increase possible generalizability of findings. The firms were in different industries and ranged in size from $40 million to $8 billion in annual sales (median = $2.6 billion). They exhibited wide variations on a number of characteristics, including the following: service versus manufacturing industries, rapid growth versus stability, capital- versus labor-intensive production processes, high- versus low-technology products, customer base (government versus commercial, consumer versus industrial marketing), and degree of diversification.

In each firm, initial interviews were conducted with corporate-level managers, including the chief financial officer and/or controller, top-level general managers (chairman, president, chief executive officer, chief operating officer), staff officers (vice president, administration; vice president, planning; treasurer), and other financial staff (assistant controller, director of internal audit). These interviews were used to gather information on the firm's businesses, its organization, its current business situation, and its control systems, including planning, budgeting, measurement, and incentive compensation, as applied to PCs within the firm.

Interviews were then conducted within a small number (from two to six) of PCs in each firm and at the organization level of the PC managers' immediate superiors. The PCs were selected (in discussions between the authors and corporate managers) to provide a cross-section of those in the corporation. The only constraint imposed was that the interviews be conducted within North America. In each of the 54 PCs selected for study, the PC manager was interviewed and, where possible, his or her immediate superior and the controllers reporting both to the PC manager and the superior were also interviewed. Typically, the PC manager interviews were two hours in length and the other interviews were one hour.

In sum, 203 individuals were interviewed for a total of 312 meeting hours. Two interviewers were present at most of the meetings. To enhance the consistency of the investigations, the principal author participated in all but three of the interviews.

Measures

Budget-target achievability was measured from both an *ex ante* and *ex post* standpoint. The *ex ante* measure was a subjective probability estimate of achievability gathered from multiple respondents including the PC managers and, where possible, immediate superiors and controllers at both organization levels.[6] Each manager was asked the following question:

> At the time your profit budget for this year was approved, what did you feel the probability was that it would at least be achieved?

To improve the reliability of these responses, we asked the question in several ways using Chesley's [1975] suggestions for eliciting subjective probabilities.[7]

The *ex post* measure of budget achievability was in the form of information on the PCs' past- and current-year performances as compared with budget targets. These data were not available for the whole sample, but the existing data provide some validation of the managers' estimates and comments.[8]

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[6] Inclusion in the sample of the incumbents of identical positions in each profit center increases the representativeness and standardization of the data. Use of multiple informants in semistructured interviews increases the validity of the data [Seidler, 1974, pp. 816–820].

[7] For example, if the interviewee responded that the subjective probability of achieving the budget was 90 percent, we sometimes asked if this figure meant that the budget was relatively easy to make, or if it meant that there was a 10 percent probability of something going wrong. These questions often made the interviewees think more deeply about their responses. On no occasion, however, did it cause any of the respondents to alter their initial estimates.

[8] The historical data set is incomplete for two basic reasons. First, in the corporations studied early, we neglected to ask for the data because we had not yet identified their value. Second, in some situations we judged

Finally, to test whether the data were consistent with the corporations' budget-target philosophies, a questionnaire was sent to the most senior financial executive (generally the CFO) with whom we had contact in each firm. One of the questionnaire items asked respondents to rate their extent of agreement, on a scale from one (strongly disagree) to five (strongly agree), with the following statement:

> Annual profit budgets are commitments from our general managers to the corporation. They are expected to make their targets.

CFOs (or their equivalent) in 11 of the 12 corporations responded.

FINDINGS

Number of Budget Targets

Research question 1 motivated the exploration of whether PCs have more than one budget target. In each of the 12 corporations, a single detailed budget is prepared, although one corporation does a small amount of contingency budgeting, one uses a form of flexible budgeting to supplement its static budgets, and one uses tacit corporate-level reserves to protect against possible optimism in the PC budgets ("bottom-drawer phenomenon"). Most of the corporations, however, do identify more than one financial target within the framework of an annual bonus plan. Nine identify a threshold level of performance; if actual profit performance falls below this level, PC managers are paid no bonuses and in some cases they are warned that their jobs are in jeopardy.

Nine of the corporations (not the same nine) identify a maximum performance level that is associated with the maximum bonus. In only one corporation is the maximum performance level equal to the budget level (and in this corporation, the condition exists for only about half of its PCs). Thus, in 11 of the 12 firms, PC managers are paid extra bonuses for exceeding budget levels of performance.

Distribution of Budget-Target Achievability

The budget-target achievability finding contrasts sharply with the findings of the existing descriptive surveys. A large majority of the PC managers interviewed estimated high probabilities of achieving their budget targets, and they reported that, historically, they have achieved their targets much more often than not.

Table 1 shows the *ex ante* subjective probabilities of budget-target achievement. Of the 45 PC managers responding to the subjective probability question, 39 (87 percent) reported a probability greater than or equal to 75 percent.[9] Even more striking, 24 (53 percent) reported a probability of 90 percent or greater, while only 3 (7 percent) felt they had less than a 50 percent chance of achieving their target. The median response was 90 percent; the mean was 83 percent.

The historical data support the managers' subjective estimates of success. Data were collected on the budget-target achievement of 39 of the 54 PCs for the

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that the data were not indicative of the current situation because the organization structure or the PC manager had changed.

[9] This data set is also incomplete for two basic reasons. First, some interviews were not possible because the role did not exist (particularly PC controller), the role was not filled, the person in the role was too new or otherwise not knowledgeable about the relevant questions (not part of the management team), or scheduling could not be arranged. Second, some individuals did not answer the question about budget-target achievability either because they were not asked (they were interviewed before achievability had been identified as a focal issue) or because they were unable or unwilling to put a probabilistic estimate on the likelihood of achievement.

TABLE 1

SUBJECTIVE PROBABILITY OF BUDGET-TARGET ACHIEVEMENT AT TIME OF BUDGET APPROVAL

Entity		*Probability Estimates*			
		Profit Center Level		*Level of Immediate Superior*	
Corporation	*Profit Center*	*General Manager*	*Controller*	*General Manager*	*Controller*
A (Diversified luxury goods)	1	90%	85%	b[1]	b
	2	0	40	b	b
	3	80	95	90%	100%
	4	75	—	78	—
	5	80	—	b	—
B (Electronic equipment)	1	88	a	50	a
	2	90	70	a	50
	3	23	a	30	a
C (Distribution)	1	100	100	a	a
	2	90	b	a	a
	3	90	90	a	a
	4	90	a	75	70
	5	75	—	75	b
	6	60	—	75	b
D (Diversified industrial products)	1	100	b	78	a
	2	90	b	55	a
	3	b	80	a	a
	4	99	b	a	a
E (Diversified chemicals)	1	30	38	10	a
	2	75	50	50	a
	3	b	a	a	a
	4	85	—	a	50
	5	73	50	a	—
	6	b	a	a	a
F (Hospitality)	1	b	—	95	—
	2	90	—	90	—
	3	95	—	95	—
	4	b	—	80	—
	5	100	—	100	—
	6	b	—	a	—

year completed before the interview. Of these, 29 (74 percent) achieved or exceeded their budget targets. In addition, 21 PC managers gave their latest estimates of budget achievement in the current fiscal year (on average half completed); 18 (86 percent) reported they were confident they would achieve their budget targets.[10]

The high probabilities of achievement are probably not specific to the interview year. Many managers spoke proudly of their ongoing streak of achieving their budget targets, including one who re-

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[10] This data set is incomplete for the same reasons as for Table 1. In addition, data on the current, revised estimates of budget-target achievement were not collected when the interviews occurred early in the fiscal year.

TABLE 1—*Continued*

Entity		*Probability Estimates*			
		Profit Center Level		*Level of Immediate Superior*	
Corporation	*Profit Center*	*General Manager*	*Controller*	*General Manager*	*Controller*
G	1	90%	a	100%	100%
(Electrical connectors)	2	80	a	100	70
	3	97	b	100	100
	4	63	a	100	90
H	1	b	b	b	—
(High technology)	2	100	—	b	a
	3	b	—	b	a
	4	90	a	a	—
	5	99	b	a	—
J	1	93	b	a	b
(Consumer products)	2	95	b	b	b
	3	100	99	b	b
	4	95	a	99	70
	5	80	80	a	80
K	1	83	90	a	80
(Electronic systems)	2	75	—	a	80
	3	b	—	b	75
L	1	90	78	b	a
(Specialty chemicals)	2	85	>50	b	a
	3	100	80	b	a
	4	100	—	100	b
	5	80	—	a	a
M	1	80	80	80	b
(Consumer durables)	2	80	b	a	a

[1] Symbols:
— position does not exist
a. was not interviewed
b. did not answer question

ported never missing a budget in his 33 years as a manager. Also, the controller of one firm provided five-year histories of the budget performance of three of the PCs included in the sample.[11] He reported that these PCs achieved their profit targets in 12 of the 15 profit-center-years. Furthermore, because the overachievements were considerably larger than the misses, the average actual profit performance for those years exceeded the budget targets by 39.5 percent. Finally, the questionnaire responses show a corporate budget philosophy consistent with high budget achievability. All 11 respondents agreed with the statement that profit budgets are commitments from the PC managers to the corporation; of these 11, three agreed "strongly."

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[11] The fourth (PC 3) was part of a division that was being divested (for lack of strategic fit, not poor performance), and historical records were not easily accessible.

Thus, the available evidence suggests that a large majority of PC budget targets are highly achievable. It is tempting to call these budgets "easy," but almost all the PC managers interviewed objected to this term. As one manager put it:

> We have to work very hard to make it happen. . . . Each day is a struggle for us. . . . It's not like we're coasting.

After hearing the managers talk about the highly achievable budget targets, we conclude that these targets can best be described as *challenging, but very likely to be achieved by the PC management team if they exert a consistently high level of effort*. This meaning is attached to the expression "highly achievable budget target" throughout the remainder of the paper.

In other terms, highly achievable budget targets assume that managers will work as hard as they can but *protect them to some extent against possible negative exogenous influences*. This interpretation is consistent with a "tight, but attainable" budgeting philosophy, which is espoused by both PC and corporate managers. A key difference between the managers' philosophy and textbook writings, however, is that the managers' budgets are not missed more than, or anywhere near 50 percent of the time, nor do "many managers . . . fail to meet [them] by a small margin," as Otley [1982, p. 39] suggested. The reasons for this key difference are described in the following sections.

Factors Affecting Budget-Target Achievability

Highly achievable budget targets are consistent with the theory that PC managers create high amounts of budgetary slack that go undetected by top management. Our findings suggest, however, that the PC managers' superiors are generally aware of the high achievability of the PC budget targets. The Table 1 data show that the superiors' budget achievability estimates are not systematically different from those of the PC managers. For the 21 PCs for which both estimates are available, the mean probability is 80 percent for the PC managers and 78 percent for their superiors.

These data and the understanding obtained during the interviews led to the conclusion that the primary parties involved in the target-setting processes—PC managers and top management—typically have incentives to establish highly achievable PC budget targets. Budget-target setting is best described as a bargaining process between parties whose incentives are, in the vast majority of cases, well aligned.

INCENTIVES TO NEGOTIATE FOR HIGHLY ACHIEVABLE BUDGET TARGETS

PC Managers' Incentives

1. *Increase expected bonuses*. Nine of the corporations' bonus contracts (or plans) explicitly state that PC managers start earning bonuses at a lower bound that is either equal to or a function of the budget target. Furthermore, in these and two other firms, the size of the bonus is influenced by whether budget targets are met. Thus, other things equal, managers in 11 of the 12 corporations can increase the expected values of their bonuses by negotiating a lower budget target.

2. *Protect management credibility and autonomy*. Managers in all 12 corporations are subjected to top-down pressure to meet the budget target. Managers who miss targets suffer credibility losses that harm promotion possibilities, chances

for good salary increases, and ability to sell their ideas and to have resources allocated to their PCs. Furthermore, top management is more likely to intervene in the management of PCs that are under their budget targets. Thus, the PC managers risk losing some of their operating autonomy if they fail to meet their targets.[12]

3. *Increase chances of "winning."* Most PC managers have strong desires to make their budget targets because they equate achieving budget targets with "winning." "If I were to miss my budget," said one manager, "I would feel like a failure. When I exceed my budget, I feel proud." The general feeling that managers want to feel like winners and "winners are people who make their targets" provides a strong incentive for PC managers to negotiate budget targets that are likely to be achieved.[13]

4. *Increase operating flexibility.* Many of the PC managers admitted that they biased their budget profit submissions downward not only to increase the likelihood of achieving budget targets, but also to build in some slack resources to increase their operating flexibility. This flexibility reduces the need to react to every short-term contingency with sometimes extreme and costly actions such as layoffs, and it allows them to make some discretionary investments without having to request either corporate approval or budget renegotiation.

5. *Protect against inducements to overconsume resources.* Almost all PC managers face the four preceding incentives to negotiate lower, more achievable budget targets. Some mentioned a fifth incentive, a desire to avoid optimistic budgets with high forecasts of sales and profits that they consider dangerous for resource planning purposes. They felt that budgets with optimistic profit forecasts provide a sense that extra expense can be afforded. For example, managers may staff for expected high activity levels that may not be forthcoming and it is costly to eliminate unneeded resources.

Top Management's Incentives

One might expect that top management, knowing that PC managers have incentives to negotiate highly achievable targets, would try to exert an upward pressure on the targets. We found, however, that top-level managers also have significant incentives to allow highly achievable budget targets in the PCs for which they are responsible. They reported a tendency to accept PC manager's conservative budget submissions with, perhaps, minor upward modifications, and sometimes they actually lower targets that they feel are optimistic. They reported any of seven incentives for doing so:

1. *Increase predictability of corporate earnings.* Some corporate managers treat budget targets as PC managers' commitments to the corporation to increase the predictability of corporate earnings. The philosophy that the budget is a commitment provides top management with some peace of mind. The consolidated PC budgets represent a highly probable lower bound of the annual corporate profit.

2. *Protect against overconsumption of resources.* Corporate managers share

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[12] Thus, while bonus plans are bounded piece-rate plans, the organizational penalties associated with missing budget confer to the reward system some all-or-nothing properties.

[13] This finding is consistent with that of Maccoby [1976] who found that many modern managers, whom he called "gamesmen," are interested in proving themselves as "winners." But they also tend to be worriers, "constantly on the lookout for something that might go wrong" [p. 49]. Both traits would lead the managers to negotiate for achievable (even conservative) budget targets.

PC managers' concern about the tendency of optimistic plans to induce overconsumption of resources. In the words of one corporate president:

> I think we ought to have a semiaggressive plan, but one that is achievable. We want to make it every year. It's too hard to adjust on the downside, to slough off commitments of expenses, or not launch something you have a psychological commitment to.

3. *Reduce risk of lack of goal commitment*. Most corporate managers recognize the importance of PC managers being committed to their budget targets throughout the year. Lack of commitment leads to reduced motivation and an inclination to position their PC for the following accounting periods by loading expenses into the current period.

Loss of target commitment during the year is most likely where PCs are affected by large, unforeseen influences that adversely affect their earnings (e.g., recession, price war). As the vice president–finance of one corporation expressed it:

> You want [a budget target] that is achievable but that does not require a superhuman effort to make it. . . . The probability of success when the budget is approved should be between 75 percent and 90 percent. A 50 percent probability is inadequate because the first negative incident can make people give up.

Corporate managers can protect against the loss of commitment by agreeing to adjust the budget targets (or actual performance) *ex post* for the effects of these influences. Managers in the vast majority of the firms are reluctant to make these adjustments, however, because:

1. Such adjustments almost invariably require subjectivity evaluations. Most PC managers do not like subjectivity in performance evaluations because they fear biases and favoritism.
2. PC managers can spend considerable time trying to influence their bosses' decisions as to what needs to be adjusted, at the expense of effectively managing their units.

Highly achievable budget targets essentially incorporate an *ex ante* allowance for the unforeseen, negative influences and thus decrease the risk that PC managers must bear. Even though the targets do not require maximum effort to be achieved, most corporate executives and PC managers interviewed expressed more concern about PC personnel giving up than about their "coasting."

4. *Reduce need for control analyses/interventions*. In most corporations, budgets are used to implement a management-by-exception philosophy; negative variances from budget signal the need for intervention, or at least investigation. Highly achievable budget targets make negative variances relatively rare and top management attention is directed to the few situations in which problems are most likely and most acute.

5. *Allocate discretion to effective managers*. Highly achievable budget targets are consistent with the theory that PC managers create large budgetary slack. The interview data suggest that budgetary slack is indeed common. Top management allows slack both to reward good performance and to allow the PCs increased operating discretion, hoping to stimulate creative thinking. The PC managers in this study enjoying the largest amounts of budgetary flexibility are long-time employees of their firms who have demonstrated their effectiveness over an extended period. Top management apparently trusts these managers to

make good judgments about consuming the slack and relies on them to continue working hard.[14]

6. *Reduce incentives to engage in harmful earnings management practices.* Short-term "earnings management" is one means available to most PC managers for achieving their budget targets. It includes taking potentially risky operating actions (e.g., delaying preventive maintenance) and engaging in deceptive accounting practices (e.g., manipulating reserves). A large majority of the managers interviewed described ways that they could manage earnings if the need arose. Moreover, most of them believed that should they do so, they could conceal their actions (up to a point) from their superiors, the corporate finance organization, and auditors.

The danger of earnings management varies across corporations and across PCs within corporations. Some PC managers have greater abilities to manage earnings because, for example, they can move sales and discretionary expenses between accounting periods. In addition, some corporations have a greater ability than others to control these actions because they have a strong internal audit function or solid line reporting of PC controllers into the finance organization. Among top-level managers, however, the concern that too much earnings pressure could trigger these manipulative short-term behaviors is pervasive.

7. *Ensure a competitive compensation package.* In two of the corporations, top management allowed all or some PC managers to have highly achievable budget targets to ensure that some performance-dependent bonuses would be earned in order to provide the managers with a competitive compensation package. The need for almost-guaranteed bonuses arose because in both cases top management had frozen salaries during difficult operating times. When the freeze was removed, salaries were below competitive levels, but top management was reluctant to increase the corporation's fixed costs sharply through an immediate boost of salaries. Instead, both corporations began using variable compensation (bonuses) to make the managers' total compensation packages competitive with industry and local averages.

The influence of compensation practices on budget-target achievability may be greater when compensation consultants are involved. Members of two major compensation consulting firms told us that consultants generally design compensation packages assuming payment of a "target bonus" which most firms choose to calibrate based on achievement of budget targets. This method of calibration creates organizational pressures to set budget targets that will be achieved most of the time because achievement is necessary for compensation to reach competitive levels.

BUDGET ACHIEVABILITY AS A PART OF THE CONTROL SYSTEM

The preceding discussion described one purpose of highly achievable budget targets as protecting PC managers against some of the downside risk of exogenous factors. Baiman [1982] suggested that when rewards are contingent on performance, tradeoffs have to be made between the motivational properties of the reward structure and the risk that managers have to bear and highly achievable budget targets may be the outcome of such a tradeoff.

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[14] This is consistent with Holmstrom's [1979] conclusion that long-term employment relations contribute to alleviating the moral hazard problem. It is also consistent with the possibility that these managers have accumulated more power in the organization and use this power to enhance their bargaining position. For a discussion of how managers accumulate and use organizational power, see Kanter [1977].

This tradeoff view, however, implies that some motivation is lost when highly achievable budget targets are set. This conclusion may not be correct. Allowing hard working managers to "win" nearly every year seems to have positive motivational effects by preserving an upbeat emotional spirit and, thereby, inducing managers to raise their aspirations level for the following year.[15] Managers who feel good about themselves and their organizations seem to be more likely to be highly energized and willing to take prudent risks.

It remains possible that highly achievable budget targets can lose most of their motivational properties if, *during a year*, the exogenous factors unfold to make achievement of the budget nearly certain. However, virtually all the managers interviewed stated the belief that their corporation's management systems have been structured to give PC managers reasons to strive for (and produce) earnings in excess of their budget targets. Almost all PC managers are promised substantial extra bonuses for performance exceeding budget. They are also given other incentives, including the recognition associated with high performers, credibility leading to increased command over resources, and increased prospects for advancement. Furthermore, some PC managers are given little choice but to produce earnings in excess of their budget targets because it is not uncommon for top management to call PC managers during the year and ask them to "turn in more" profit than originally budgeted. These requests are apparently often made to offset below-budget performances of other PCs, but they also serve to provide challenge for PCs that have enjoyed some good fortune.[16]

LESS ACHIEVABLE BUDGET TARGETS

Despite incentives inducing both PC managers and top management to establish highly achievable budget targets, for a few situations managers described the probability of achievement of their budget targets as low (0–30 percent). PC managers facing these less achievable budget targets reported that the targets did not induce them to work more hours (they were already working hard), but they said the targets did change their attitudes toward costs and, thereby, led to increased reported profits in the short term. These managers took painful actions, such as reducing discretionary expenditures and effecting layoffs. They were not sure whether these actions would have irreparable, long-term consequences.[17] These managers reported a personal commitment to try to achieve these targets and expressed no despair or discouragement. None of these managers, however, had missed budget targets for more than two years in a row.

The forces behind less achievable budget targets can come from either corporate management or PC management and are described below.

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[15] There is a large body of evidence on the level of aspiration and how aspiration increases following feelings of success (see Lewin et al. [1944] and Bandura and Cervone [1983]). Also, Hollenbeck and Williams [1987] and Locke et al. [1984] provide evidence that past performance is a major determinant of the goal level chosen.

[16] When top management issues such an order, it modifies the structure of the rewards associated with budget-target achievement by increasing the value of the dollars delivered today. The PC managers can enhance their reputations of reliability and competence by delivering what is required, thus building some organizational power [Kanter, 1977]. The sword is double-edged, however, as they can also create or enhance their reputations as sandbaggers.

[17] Several managers explained that decisions based on *quarterly* budgets often had detrimental effects. For example, for one corporation K group, repeated end-of-quarter discounting had led to a situation in which 85 percent of the quarterly sales were recorded in the quarter's last month. This group was having difficulty breaking this costly pattern.

Corporate Managers' Motives for Requiring Less Achievable Budget Targets

1. *Corporate desire for immediate profit.* When corporate managers perceive an urgent need for short-term earnings, they may feel that the benefits of less achievable budget targets outweigh the associated costs and risks. The perceived urgency may occur for any number of reasons, such as the desire to signal stability to customers or creditors or the desire to boost stock price to dissuade a takeover. In these situations, top-level managers tend to rely most heavily on relatively large PCs for the additional profits. Small PCs often escape unscathed because even a sharp increase in their budget targets will not greatly increase corporate profit.

2. *Desire to signal that short-term profit is the PC's priority.* Even when corporate profit is not an immediate concern, top management may require aggressive budget targets to signal to PC managers that short-term profit is a now priority (e.g., to reflect transition from development to an emphasis on profitability). A less achievable budget target provides a signal that the PC's mission has changed, thus reinforcing strategy discussions, and limits the PC managers' discretion. Harmful myopic actions (e.g., cutting of crucial developmental expenditures) are not a problem because cost-cutting is the mandated corporate objective.

3. *Dissatisfaction with a PC's performance.* When top-level managers feel that the performance of particular PC managers (or management teams) has been weak, or when they suspect "organizational fat," they sometimes impose a budget target to which the profit center managers attach a low probability of achievement. This action has three purposes. First, it provides a signal to the managers that performance improvements are expected. Signalling through the budget is powerful because the many rewards and punishments that are linked with achieving budget targets ensure that the message will be received. Second, it reduces the discretion of managers whose performances are judged unsatisfactory. Third, it sets up a clear rationale for relieving the managers of their jobs. In these situations the risk of harming the long-term health of the business through cost-cutting is small; the managers will first respond by eliminating or reducing inefficiencies, before they cut useful investments. Furthermore, hurting the feelings of poor performing PC managers is not a major top management concern.

4. *Desire to make interyear adjustments for managers' good luck in prior year(s).* As discussed earlier, most managers are reluctant to adjust budgets *ex post*. They also have difficulty equalizing budget achievability across divisions *ex ante*. Although most corporate and group managers agreed that they would like to equalize budget difficulty, the pervasive feeling was that doing so was impossible. In an attempt to be fair to PC managers, some corporate and group executives make interyear adjustments by requiring less achievable budget targets (or by accepting easily achievable targets) depending on whether the managers have been lucky (or unlucky) in the past year(s).

PC Managers' Motives for Submitting Less Achievable Budget Targets

PC managers can also provide the impetus for less achievable budget targets because they sometimes have incentives to submit optimistic (less achievable) budgets. This planning bias, which Lowe and Shaw [1968] term "negative slack," was observed in several corporations where it was caused by any of four different motivations.

1. *Improve ability to compete for organizational resources*. Budgets are part of the bargaining process in which managers compete for organizational resources [Hopwood, 1974, p. 42]. To obtain funds, requests must be supported by acceptable and credible returns on the proposed investments.

2. *Signal managerial ability*. Negotiating budget targets almost always involves a series of meetings with managers from multiple organizational levels. These meetings provide PC managers opportunities to signal to higher-level managers their initiative, energy, creativity, and qualification for higher duties. These signals are often undercut when the managers attempt to negotiate for conservative budgets.

3. *Survive*. PCs that are performing well can secure organizational resources and signal managerial competence by *delivering* results (i.e., exceeding budget) instead of by *promising* those results. Bad performers, however, do not have track records that generate confidence. Accordingly, they submit optimistic budgets on their own, knowing that if they fail to achieve the higher, less achievable level of performance, they will probably lose their jobs anyway.[18]

4. *Enhance personal challenge*. Most PC managers have risen through the management ranks because they are high achievers with strong internal drives. Such individuals have a tendency to budget optimistically because, as one manager expressed it, "Achievers set difficult goals for themselves." Without challenging goals to strive for, their sense of arousal and competition is reduced.[19]

The strength of this desire for a challenge varies significantly across individuals. Most of the top executives felt that managers with sales or marketing backgrounds are more likely, on average, than those with other functional backgrounds to submit budgets with aggressive (less achievable) targets.

Since top management generally has incentives to establish highly achievable PC budget targets, the question is raised as to why top-level managers would accept optimistic budgets from PC managers. Three answers are conceivable: (1) top-level managers are unable to detect the optimism, (2) they are reluctant to remove it, or (3) they value it. We found no significant examples of an inability (or, at least, the perception of an inability) to detect optimism in budget plans. Most corporate managers avowed that they could detect optimism (or lack of realism) and that they generally chose to remove such biases from the budgets. We found a few situations where PC managers, in their role as superiors, were reluctant to remove the optimistic budget-target biases for reasons that included either "not wanting to destroy the manager's enthusiasm" or the desire to "hang them with their own numbers to teach them a lesson." And, as was described earlier, we found a few situations where top-level managers value optimism. Where they exist, PC managers' optimistic biases give superiors the option of accepting budget targets that are not likely to be achieved, but we found few examples where executives chose to exercise that option.

CONCLUSION

In this study, we found evidence that the vast majority of PC budgets investigated are challenging, but through the management team's consistent effort, very likely to be achieved. This finding was surprising insofar as it seemed inconsistent with conventional wisdom that suggests that for optimum motivation budget targets should be missed more often than they are achieved.

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[18] This is a form of bonding expenditure (see Jensen and Meckling [1976]).

[19] This is consistent with experimental evidence showing that individuals with a high need for achievement set higher goals for themselves [Matsui et al., 1982].

The finding was explored through in-depth interviews and the incentives of the primary negotiating parties—top management and PC management—were analyzed. Our explanations highlight the somewhat surprising finding that these parties' incentives are fairly well aligned, except in a few specific circumstances, and that they lead to the setting of highly achievable PC budget targets.

To summarize our explanations, PC managers want to be sure they will make their budget targets to build their management credibility, to enhance their bonuses, to give themselves some operating flexibility, and to give themselves and those in their organizations the motivational boost provided by a winning feeling. PC managers are ready to accept goals that require their working hard, but they want to be protected somewhat from the adverse impacts of exogenous factors. Corporate managers allow the PC managers to have achievable budget targets because these targets increase the predictability of corporate earnings, reduce the time spent on control analyses and interventions, and reduce the risk that the PC managers will either lose goal commitment or engage in earnings management. Some top-level managers also use highly achievable budget targets to allocate discretion to effective managers and to ensure a competitive compensation package. And both PC managers and their superiors see a need for achievable, slightly conservative budget targets to protect against inducements to over consume resources. These explanations provide the start of a predictive theory of budget achievability at PC levels in firms with multiple divisions.

The discrepancy between textbook theory and practice as we observed seems to stem from the fact that budgeting is not a system in itself, but rather is a *part of* the control system [Flamholtz, 1983]. Goal achievability *cannot* be separated from issues of compensation, design of the reward function, role of accounting measures in performance evaluation and reward, and organizational structure. Although textbooks do not argue that budgeting stands on its own, they often present only one possible design alternative and fail to highlight the complementary and compensating relationships among the various control system elements.[20]

Corporate conditions at PC organization levels are often quite different from those described in textbooks in two critically important ways. First, PC managers are held accountable for many factors over which they have little, or even no, control because it is often extremely difficult to separate the endogenous and exogenous performance factors. Corporations are generally unable to implement flexible budgets or explicit forms of variance analyses related to specific factors (e.g., see Merchant [1987]). Thus, any adjustments for uncontrollable factors are bound to involve subjectivity, and most managers interviewed (subordinates as well as superiors) expressed a strong dislike for allowing significant amounts of subjectivity to enter into performance evaluations.[21]

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[20] There are some notable exceptions. For example, Dopuch et al. [1982] and Magee [1986] follow arguments made in Demski and Feltham [1978] and outline the close interdependence between goal setting and design of the reward function.

[21] This finding is consistent with the large amount of evidence indicating that subjectivity in performance eval-

And second, highly achievable budget targets often have practical advantages that can more than offset whatever motivational deterioration they may cause. The achievable targets can improve corporate financial reporting, resource planning, control, and in some situations, compensation.

LIMITATIONS

The findings presented in this paper must be described as tentative. This study did not build on the findings of prior studies because very little prior evidence existed either about managers' choices of levels of profit center budget achievability or about the factors that influence those choices. The study also has several significant limitations.

The corporate sample is one limitation. The 12 corporations studied obviously do not span all industries, and it is likely that other influences on budget achievability exist in other settings.

A second limitation is on the number of PCs studied in each corporation. The PCs chosen were intended to represent a cross-section of PCs in the firm. In several (but not all) of the companies, corporate managers appeared to steer us away from talking to managers in troubled PCs for reasons such as "they're too busy," or "the manager is too new." In some instances, we were able to gather secondhand information on the poor performing PCs, but it remains likely that PCs in difficulty are underrepresented in the sample of 54 PCs.

Third, the interviews were conducted during a relatively good economic period. Since budgets tend to become tighter when economic conditions worsen (e.g., Merchant [1985b]), researchers conducting a similar study during a recessionary period would probably find budget targets that were less achievable, on average.

Fourth, the managers' subjective estimates of the probability of budget achievement were the primary evidence of budget-target achievability. These data were often collected in the middle of the fiscal year, so their accuracy depends on managers' recollections of their feelings at the time the budget was approved. Ideally, the PC data would have been collected shortly after budget approval and would have included a full set of data on historical budget accomplishment. While we acknowledge these limitations to the data, we have confidence that the estimates we received are reasonably accurate. We have evidence that the managers were able to distinguish their estimates from knowledge of subsequent events, and the partial set of historical data collected is quite similar to the subjective data.

Finally, some would criticize the use of interviews for data collection with the assertion that managers' responses are likely to be biased. We acknowledge that possibility. However, we were able to follow up the responses in some depth if the interviewees' logic was not internally consistent, and we posed the questions to multiple respondents to cross-check the answers for reliability. The number of contradictions we discovered in facts or perceptions was minimal.

Subjective estimates of the probability

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uation and reward poses significant practical problems. For example, individuals tend to overrate their performance (see Baker et al. [1988]). Individuals tend to attribute success to internal factors but failure to external uncontrollable factors [Lewin et al., 1944; Reinfenberg, 1986; and Russell and McAuley, 1986]. And superiors avoid subjectivity because they lack specific information about subordinates' performances and fear interpersonal conflict, while subordinates do not trust superiors to evaluate their performance accurately [Longenecker and Gioia, 1988].

of budget achievement are superior to the verbal scales used in some prior research because their quantitative nature makes them more comparable across settings. The managers' estimates may not reflect difficulty of budget achievement, however. Measuring difficulty would involve assessing the size of the gap between current performance and planned performance; in other words, how far out the target is pushed. Managers' subjective estimates of achievability are affected by difficulty, but they are also affected by other confounding factors—managers' abilities to manipulate short-term earnings reports, managerial (and organizational) talents and expected levels of effort, and a potentially large number of uncontrollable factors that affect earnings both favorably and unfavorably. Because in-depth interviews allowed us to develop a good understanding of the meaning each manager associated with his or her estimate, each of these factors appears either directly or indirectly in our explanations of the observed levels of budget achievability. Admittedly, though, our adjustments lack the precision of quantitative measures.

Subject to these limitations, our findings suggest that budget achievability is an important organizational control-system variable, as managerial choices about it can have significant effects on individuals and organizations. Furthermore, textbook prescriptions do not seem to describe the practices that appear to dominate at the PC-organization level in most firms.

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BOOK REVIEWS

Richard P. Brief, Editor

Editor's Note: Books for review should be sent to Professor Shane R. Moriarity, School of Accounting, University of Oklahoma, Norman, OK 73019.

JOSE ANTONIO GONZALO ANGULO and JORGE TUA PEREDA, *Introducción a la Contabilidad Internacional* (Madrid: Ministerio de Economía y Hacienda, 1988, pp. 256).

The purpose of this book is to promote the study of international accounting in Spanish higher education, a subject which is only just emerging as part of the accounting curriculum in that country. To this end, the two authors, Gonzalo Angulo of the University of Alcalá de Henares and Tua Pereda of the Autonomous University of Madrid, propose to outline a course of study in international accounting. But they actually accomplish much more. The authors review, in a clear and succinct manner, the major literature on international accounting, thus providing a useful—and to my knowledge, unique—introduction to the field for both student and aspiring researcher alike.

In terms of structure and content, the volume consists of seven chapters and an extensive bibliography. For the most part, the authors rely on previously published material. They begin by making a case for international accounting as an independent, university-level discipline, an issue which, apparently, has yet to be resolved among accounting educators in Spain. The authors then examine the major concepts in the study of the field, using for that purpose the standard topical approach. They cover the various classification schemes for international accounting systems; the theoretical aspects of worldwide accounting regulation; the international accounting organizations; and international auditing standards and issues. The most extensive coverage is reserved for the accounting problems of multinationals and includes discussion of consolidated financial statements, foreign currency translation, accounting for changing prices, segmental reporting, financial statement analysis, taxation issues, transfer pricing, and internal control and evaluation.

While this selection of topics is a standard one among the few textbooks in international accounting now available, *Introducción a la Contabilidad Internacional* is not a full-fledged textbook, at least in the American sense, but a monograph. It comprises no study problems or exercises, and the text of the work contains frequent citations to the research literature, giving it much more the flavor of a literature review. The lengthy bibliography is also indicative of this approach.

The bibliography is the most outstanding feature of this work and is probably the most comprehensive listing of scholarly research in international accounting currently available. It covers 25 pages and is multilingual in scope, listing the books, monographs, published papers, and conference presentations of American, Spanish, English, French, Canadian, German, and Japanese researchers, among others. Although wide-ranging, the bibliography is decidedly Western in orientation, and American and Spanish sources predominate, the latter not surprisingly, given the nationality of the two authors. The multilingual nature of the listing illustrates an important point of particular relevance to accounting educators in the United States: a working knowledge of other languages in addition to his or her native tongue is a definite advantage for the aspiring student of international accounting.

Most students of the subject acknowledge that an understanding of historical developments is important to the study of international accounting; the authors themselves make this point at least three times in the course of their text (pp. 23, 32, and 37). It is surprising, therefore, that their bibliography includes virtually no works on accounting history, not even classic works that are indeed international in perspective, such as Vlaemminck's *Histoire et doctrines de la comptabilité* [1956] and Stevelinck's *La comptabilité à travers les âges* [1977]; or, on the shorter side, Derek T. Bailey's fine essay on European accounting history, contained in Holzer, *International Accounting* [1984].

Notwithstanding this weakness, Gonzalo Angulo and Tua Pereda have made a valuable contribution to international accounting education. I would urge the authors to have their volume translated into English in order to make it accessible to their colleagues across the Atlantic. It is simply too useful a resource not to reach the widest audience possible.

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ROBERT N. ANTHONY, *The Management Control Function* (Boston: The Harvard Business School Press, 1988, pp. ix, 207, $30.00).

Since the publication of *Planning and Control Systems* in 1965, the Anthony framework has had a profound impact on the way managerial accountants think about controllership and accounting information systems. In this revised and extended version of that earlier work, he reasserts his belief that management control is a distinct discipline, addresses project along with operating unit control, and offers a number of "generalizations" about how the process should be conducted. Its publication provides an opportune occasion to reflect on the current state and future prospects for the field.

Anthony begins by explaining the necessity of a framework for research, education, system design, and system use. His approach is to offer generalizations which apply to a typical, well-managed organization, and these are most useful when their relationship to an overall framework is understood. Generalizations specify the circumstances under which a particular management control practice, such as type of transfer price, should be used. An 18-page appendix outlines his guidelines for these generalizations and the evidence which supports them.

He then draws the boundaries around his now-familiar hierarchy, differentiating among strategic planning, management control, and activity control. Modifications include clarifying that management control actually consists of multi-cycle vertically and horizontally integrated planning and control processes, and renaming operational control as task control. The three planning and control processes are compared and contrasted, highlighting differences in problems and decisions, systems and information, behavioral, and other characteristics. These distinctions are crucial to Anthony's definition of the middle segment as management control, the control by managers of other managers, exercised cybernetically over responsibility units using, in part, accounting measurements of inputs, transformations, and outputs.

Chapters Three and Seven discuss contingencies which affect the multi-cycle management control process: organization structure, behavioral considerations, standard operating procedures, and culture; other external and internal factors include stage of product life cycle, nature of competition, strategy, degree of activity structuredness, internal consistency, interdependency, flexibility, and management style. Industry specific differences are also mentioned. Other chapters detail the planning and budgeting processes which these contingencies affect, and the design and installation of the information systems which support them. Anthony sees information systems supporting management control systems as the closest an organization can come to building a totally integrated system and that, ultimately, computers will make a significant contribution in the execution of management control functions.

Taken by themselves, Anthony's commitment to and proselytizing about his way of thinking suggests to the reader that it contains few limitations, and alternatives are of little value. Yet now, more than ever, Anthony's conception of management control and his definition of its boundaries are problematical. The demarcation between management and task control, the former focusing on responsibility units and the latter on individuals, appears to be based on the presence or absence of discretion. But, increasingly, shifts toward performance-based compensation have focused on collectivities rather than individuals as the units of analysis. And socio-technical innovations such as quality circles and autonomous work groups, and trends toward industrial democracy have all pushed discretion and collective responsibility to the shop floor, thereby blurring this separation. Anthony acknowledges that the line dividing strategic planning and management control is fuzzy and that senior management engages in both. Anthony, Dearden, and Bedford (*Management Control Systems*, Irwin, 1984, pp. 394–395) state that the distinction is not crucial and that, in practice, there is considerable overlap between strategy and long-range product/service planning. These boundaries are, however, essential to Anthony's delineation of management control and his ability to offer managerial generalizations.

The basis of his generalizations are case studies, which he believes are probably the most important source of evidence of sound management control practices. He states that few accepted behavioral science theories (and presumably, strategic management theories as well) are relevant: his references do not include the significant research in either field. Yet these disciplines are producing an increasing amount of research that calls into question the model of organization and the conception of management process on which Anthony bases his generalizations. For example, there are other views of the role of senior management. And the presumed sequential progression from strategy formulation to implementation has been suggested as also occurring in reverse causality. Such research suggests that accounting models and measures, as significant determinants of perceptions and shared meanings, affect organizations in ways totally unforeseen by control system designers proceeding in accordance with conventional assumptions.

In light of such possibilities, Anthony's framework must be seen as but one way of looking at management control. It remains a convenient simplification of reality for neophytes, and fits the academic market for courses and books, but it now may be a misleading guide for practicing managers and researchers attempting to understand and predict what actually goes on in organizations. Alternative frameworks would open the boundaries of controllership to the fields of strategic management and socio-technical systems, and be sensitive to structures and the processes throughout the organization, seeking to understand why organizations stay the same or change. The research questions such frameworks pose contrast significantly with those suggested by the Anthony model.

The need to define the spheres of interest of controllers and accounting information systems researchers is of no less significance today than it was almost a quarter of a century ago when Anthony first presented his framework. This book provides a summary of his guidepost contribution, which now must be viewed in a broader context.

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Anthony A. Atkinson, *Cost Estimation in Management Accounting* (Hamilton, Ontario: The Society of Management Accountants of Canada, 1987, pp. v, 122, $15.00 paper–members, $20.00 paper–nonmembers).

This small book will be a useful addition to almost any textbook based cost accounting course. It contains six short cases that each document a different cost estimation problem faced by a real firm. The problems covered are:

1. *Learning curves:* The company is exploring the use of learning curves as a cost estimation tool and as a control device for direct labor costs.
2. *Relevant cost:* The company has the opportunity to bid on a large contract and has to identify the costs relevant to the contract.
3. *Joint cost allocation:* A public utility has to allocate the cost of generating facilities to its customers. The case explores the different allocation schemes used by utilities.
4. *Joint cost allocation:* A company originally treated an output of its productions process as a free good. This by-product in fact has value. The case explains the relevant issues associated with the allocation of joint costs.
5. *Evaluating a preventive maintenance program:* A company has established a preventive maintenance program and wants to evaluate its effectiveness and develop some control procedures.
6. *Evaluating testing procedures:* A company uses statistical sampling to determine the quality of its products.

With the exception of the last case, the cases are all topical and shed light on the practice of management accounting. I would have liked to have seen a case on target costing, but find it difficult to fault the author for this omission given how difficult it is to get firms to agree to participate.

I take exception to the inclusion of the last case, because it deals solely with statistical sampling. Cost estimation issues play no apparent role in the problem faced by the firm. While the author correctly argues that most accounting textbooks do not include adequate coverage of statistical sampling, I do not think the case included in this book is rich enough to fill the gap.

At the end of each case the author provides an analysis of the case situation. The majority of these analyses are well thought out and help the reader to understand the issues being faced. I found the analyses of the learning curve, utility allocation, and preventive maintenance cases particularly illuminating. The analysis of the relevant cost problem I found less satisfying. The inclusion of a regression analysis that failed to shed light on the underlying cost structure was informative, but the discussion of "fixed" costs was too classical for my taste. It never really addressed the major issue of "what are fixed costs?" I would have preferred a more detailed analysis of the nature of these so-called fixed costs and a discussion on how they become relevant. In particular, the contract in question has the potential of becoming repeat business. The issue of whether a firm should bid on long-run unprofitable but positive contribution business was not discussed.

The main failing of the book is its attempt to satisfy two markets, academic and practitioner. To satisfy the academic market the cases were chosen to cover a broad range of problems. These problems were selected to be as simple as possible, so that students could understand the issues raised, while still maintaining realism. In my opinion, the author achieved these objectives remarkably well. However, I feel practitioners would have been better served by selecting a narrower range of problems and dealing with the practical issues related to them in more depth. Having two cases on each topic, one simple and one complex, would have been a better practitioner format. The learning curve case, for example, illustrates the use of learning curves for cost estimation but does little to highlight the practical problems of using that technique. A second case dealing with some of these problems would have been helpful.

My criticisms, however, are outweighed by my praises. The book is a valuable addition to the literature. It illustrates six interesting problems and demonstrates well the practice of cost estimation in the field. Professor Atkinson should be encouraged to continue this line of work.

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CALLIE BERLINER and JAMES A. BRIMSON, Editors, *Cost Management for Today's Advanced Manufacturing* (Boston, MA: Harvard Business School Press, pp. xvi, 253, $30.00).

This book reports on a study of some firms that have developed innovative approaches to cost management system (CMS) design. Chapter 1 provides the conceptual framework developed in this project. The framework is specified in terms of: key concepts; objectives; and principles that relate to costing, performance measurement, and investment management. Chapter 2 discusses the manufacturing, costing, investment analysis, and performance evaluation implications resulting from the move to computer-integrated manufacturing. Chapter 3 speculates about the environment of future manufacturing systems and specifies: the objectives that these systems will seek; a functional model to guide these organizations; and a profile of activities that these organizations will undertake. Chapter 4 develops the objectives, principles, and guidelines for developing a CMS. This chapter focuses on: management reporting issues; the need to trace and report costs more accurately; the required evolution of budgeting and standard-setting systems; inventory valuation issues; and internal control considerations. Chapter 5 surveys the concept of life-cycle management and stresses the need to understand the natural cycle and interrelationships of the engineering, manufacturing, and logistics costs related to a product. Chapter 6 identifies the key performance measurement criteria that the book argues should predominate CMS systems and suggests why traditional cost accounting measurements are dysfunctional. Chapter 7 considers the nature of the investment decision and describes a multi-attribute decision-model that weights the performance and risk of alternative projects, while focusing on: financial return; operating performance; and qualitative factors, to rank alternative investment proposals. Chapter 8 compares CMS principles to existing cost accounting standards (CAS) and identifies areas of contradiction that require resolution. Chapter 9 provides a summary of cost accounting practice observed in a sample of Japanese firms.

The title of this text is misleading. Only a small portion of the text is concerned with conceptual issues. Moreover, most of the issues discussed in this book apply in manufacturing environments that are not advanced as well as in service environments.

There are parts of the text that make a major contribution to our understanding of costing systems. In particular, Chapters 1 and 6 alone justify the text. In Chapter 1 there is an outstanding summary of the problems with extant cost systems; description of activity costing and activity analysis; and discussion of the proposed concepts, objectives, and principles for CMS. While the material is prescriptive, and is often offered gratuitously, it is based on a reflection, by the individuals involved in this project, of their collective experience. For what it is worth, my own field work in costing systems, involving over 35 firms, supports, in every respect, the conclusions reported in this chapter.

The discussion of costing and performance measurement principles constitute, perhaps unintentionally, an indictment of the problems with current approaches to cost accounting systems. I recommend this chapter to anyone who is interested in a well-written, and thoughtful, summary of what is wrong with conventional costing systems.

Chapter 6 provides an outstanding discussion of the value-added approach to cost control as well as providing a significant contribution by listing the performance measures that are important in a manufacturing environment. By providing a list of traditional accounting measures as a counterpoint to what is important to measure, the text provides an effective documentation of the deficiencies of conventional cost accounting practice.

There are other important concepts raised in this book. These include: manufacturing cycle efficiency (p. 4); the CMS engineering/manufacturing functional model (pp. 53-62); life-cycle accounting (pp. 140-142); and target cost (p. 228).

However, I was disappointed with the superficial treatment given to activity costing which was identified in the text as one of the key issues requiring attention. The text spends little effort describing: how such systems can be implemented; how the accuracy of activity costing models can be evaluated; and how to assess their cost effectiveness. There are several numerically complex, but seemingly pointless, illustrations of activity costing scattered through the text.

Moreover, none of these examples deals with the conceptual issue of what to do with the fixed costs of equipment that are joint to the products produced by the equipment. In Chapter 4, the text proposes, without any supporting argument, a value-added approach to dealing with depreciation. This approach amounts to allocating the capital costs of a machine in proportion to the time various products spend on the machine. There are potential dangers in focusing on physical, rather than value, attributes in allocating costs. While numerous discussions with my friend, Bob Kaplan, have convinced me that there are specialized arguments, relying on important assumptions, that can be used to justify this value-added approach, none of these arguments are made in this text. This is neither a trivial nor an aesthetic issue and demands attention. In this vein, I was disappointed that the text neither acknowledged, nor discussed, the extensive literature in the regulation literature relating to tracing joint equipment costs to products.

I was also troubled by the confusion apparent between cost management and cost control. My experience in many, and varied, organizations suggests that activity costing is a tool for strategic management that has little to do with short-run cost control. (For that matter, neither do budgets, standards, and variances.) I am convinced that the tools really used to manage costs are either real-time visual tools or performance measures very much along the line of those mentioned on page 171 of the text. Variances, on the other hand, are management control artifacts that provide an overall check on the efficacy of the real cost control tools. Relying on variances to control costs is a second-best control device since it is indirect, ineffective, reactive, and untimely.

I was sorry to see that the tone of the text advocated top down control. The model in the text is: management sets standards; people do the work; then management checks up. While there is some acknowledgement, for example on page 16, that people should understand the goals, targets, and standards to which they are subjected, there is no acknowledgement of the growing evidence that, once management has established its importance to the organization, effective control of costs is from the bottom up and not from the top down. An excellent illustration of what I am thinking about is the turn-around at Harley Davidson.

This is not an instructional text. Students would find the text repetitive; disjointed; the problems needlessly complex and often without apparent direction; and frustrating in that it fails to follow up on important conceptual issues that it raises. However, I recommend strongly the book as a reference since it represents the informed opinion of experienced people who have taken a thoughtful and innovative look at where we are and where we have to go if the profession of cost accounting is to survive.

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PHILIP D. BOUGEN, *Accounting and Industrial Relations*, Foundations of Accounting Series (New York and London: Garland Publishing, Inc., 1988, pp. 342, $40.00).

This volume summarizes the results of a longitudinal study which explored the interrelationship between accounting and industrial relations in a British firm of the 1920s. Archival materials from the Manchester manufacturing firm of Hans Renold were used to study the use of accounting by a joint management-labor profit-sharing committee (the founder of the firm, for whom it was named, invented the bicycle chain). Since the company was considered a model of enlightened managerial practices during the 1920s, there was also a great deal of literature written about the company's practices. Thus, the archival evidence was supplemented by the extant literature. The prime objective of the study was to explore the roles accounting played in the conduct of industrial relations.

Even prior to the period of this study, the firm of Hans Renold had been paternalistic toward its employees. Benefits included a relatively short work week, high wages, free noon meals, educational and recreational amenities, and a company nurse. Thus, it was not altogether surprising when the company instituted a profit-sharing plan. Similarly, accounting had long been emphasized at the firm for its role in assisting management. Indeed, the cost accounting and scientific management infrastructure had existed within the company since the turn of the century. Later, C. G. Renold (son of the founder and head of the company after 1916) was knighted for "his services to the cause of good management."

The archival materials upon which this study is based were official minutes of meetings of a 20-member committee. Such minutes may represent accurate accounts of what occurred; however, it must be remembered that the recording of minutes involves a summarization process. Consequently, researchers must use caution in using minutes which may have been prepared for propaganda purposes.

The profit-sharing scheme was based on income, but only after a deduction for an expense item entitled "Wages of Capital," which appeared along with other wages. "Wages of Capital" was defined as something in the nature of interest on War Loans, "plus something more because of the extra risk involved." Any surplus was to be divided among capital, staff, and labor. At the division level, profits were measured as the difference between standard costs and actual costs. Each month stood alone; bonuses were computed and paid monthly and there was no "making up of past deficits." As might be expected, the employees' criticisms of this plan centered around whether capital should share in the distribution of surplus and with what depreciation rates should be used.

An acknowledged purpose of the scheme, besides profit sharing, was to provide financial statements to workers to permit them a first-hand knowledge of the business and the problems that the business faced. This was to give employees the conviction that they were getting a square deal and were not working merely to enrich other people. The overriding concern seemed to hinge upon Renold's belief that industrial relations could be improved by the wider dissemination of information to employees. The scheme was self financing in that it was contingent upon implementation of a management control system and the ability of employees to secure operational efficiencies.

Seemingly, Renold was able to implement a new motivational tool and simultaneously establish a new management control system during a period of unionization. The bonus system required a new managerial accounting system, and the accounting system was needed to properly manage the company. Thus, accounting filled a role as the means of generating an intellectual basis for the legitimization of managerial prerogatives.

This volume is not light reading and should not be selected for entertainment purposes. Faulknerian-length sentences and paragraphs appeared throughout; on many pages, sentences averaged 100 words each, and there was less than one paragraph per page. However, the book does have an extensive bibliography and should be required reading for accounting scholars conducting research in the area of industrial relations.

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KENNETH R. FERRIS, Editor, *Behavioral Accounting Research: A Critical Analysis* (Columbus, OH: Century VII Publishing Company, 1988, pp. 368, $17.00 paper).

This book represents a collection of commissioned papers the purpose of which are "to critically review and evaluate the state-of-the-art of behavioral accounting research (BAR) and to suggest new directions for further inquiry" (p. ix). The book is generally structured around accounting subdisciplines. Its three main parts focus on research in financial accounting (five chapters), management accounting (four chapters), and auditing (three chapters). In addition, there is an overview chapter and a concluding chapter on research methods in BAR.

A problem faced by Ferris in compiling this book is the lack of common agreement on the boundaries of BAR and on the relative importance of its elements. A narrow definition of the field is vulnerable to criticism that it unnecessarily restricts the issues, paradigms, and methods which comprise the scholarly domain. On the other hand, a very broad definition of the field may be criticized for failure to sufficiently differentiate BAR from other accounting research domains. Ferris has chosen to err on the side of a broad BAR definition.

The first major section of the book deals with financial accounting applications. Of these five chapters, I found the one by Richardson and Gibbins to be most impressive. Focusing on the production and use of financial information, the authors build a useful framework for behavioral research in the area. Their synthesis of existing literature is a creative and insightful blend of what might otherwise seem to be unrelated work. Unfortunately, most of the remaining chapters in the book did not measure up to the high standard established in this chapter. The other chapters in this section dealt with communication issues (by Parker), policy formulation (by San Miguel), human resource accounting (by Flamholtz and Lombardi Bullen), and social accounting history (by Tinker, Lehman, and Neimark). The first and second of these provide interesting frameworks for research in the area, but they do not advance our understanding of theory nor empirical results. The chapter by Flamholtz and Lombardi Bullen is a competently done literature review, although the reason for having it as a separate chapter in this book is unclear. The chapter by Tinker et al. is an interesting historical essay, but, as the authors admit, it does not deal strictly with BAR issues. Consequently, the essay does little to facilitate achievement of the book's objective.

The second major section of the book deals with management accounting. Of these four chapters, I thoroughly enjoyed the piece by Young which addresses research on performance, motivation, and control at the individual level. The chapter is tightly written and displays keen insight about the evolution of research related to budgets and standards. It nicely weaves together a wide array of studies which range from organizational behavior applications to experimental tests of agency theory. The chapter by Shields on experimental research in managerial decision making provides excellent treatment of methodological issues in this field, as well as some useful evaluation of the field's evolution to date. Chapters on structural and environmental issues in organizational behavior (by Otley and Wilkinson) and on accounting information systems (by Ko and Mock) round out this part of the book. These chapters lay out some additional BAR issues and review existing work in a generally adequate manner. One noteworthy exception is the poor coverage of presentation mode literature in the Ko and Mock chapter. Some of this problem may be due to timing of chapter writing, discussed below.

The third major section of the book deals with auditing. The chapters address group and organizational issues in CPA firms (by Jiambalvo and Pratt), individual behavior with a strongly motivational theory flavor (by Ferris and Dillard), and judgment consensus and experience (by Wright). All three chapters contained competent summaries of existing literature and are quite readable. The Jiambalvo and Pratt chapter provokes some new ideas for BAR, but I found the other two somewhat lacking in this regard. Wright's last two pages address a much broader range of research than the focus of the rest of his chapter. I wish that he had developed these ideas more fully in the chapter. The main deficiency in this section of the book is the lack of coverage on mainstream research in audit judgment and decision making, particularly recent developments in research on knowledge structures, memory, and expertise. In my view, this is a very serious omission from the book, considering the magnitude and importance of such work in the evolution of BAR.

The last chapter of the book is on research methods (by Brownell and Trotman). Much of it is fairly standard treatment of experimental and nonexperimental designs and issues. The chapter is well-written and full of good examples from various accounting topics which bring the subject to life.

In conclusion, the book by Ferris is a useful addition to the literature, certainly for those interested in surveying most (but not all) of the important developments in BAR. The book is stronger on synthesis than it is on providing new directions. Finally, the book is vulnerable to the fate of a short shelf life due to the rapidly expanding body of knowledge. In fact, it appears that, although the book has a 1988 copyright, several of the chapters were written much earlier. Very few of the references are post-1985, so the reader is warned that the book cannot possibly represent the state-of-the-art today.

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JOHN J. GLYNN, *Public Sector Financial Control & Accounting* (London: Basil Blackwell Ltd. and New York: Basil

Blackwell, Inc., 1988, pp. x, 278, $74.95 cloth, $19.95 paper).

The objective of *Public Sector Financial Control & Accounting* is to provide an introductory discussion of accounting and financial control in the public sector. To accomplish this objective, the book covers a broad array of topics relating to public sector activities in the United Kingdom, but does not give any "in-depth" technical discussions. These general issues are discussed in the first half of the book, while the second half contains chapters on each of the main public sector divisions in the United Kingdom—central government, local government, national health service, and nationalized industries.

Chapter 1 attempts to develop the context for ten succeeding chapters. It defines the size and structure of the public sector, and considers the broad objectives of accounting. Public sector accounting and control topics appear in Chapters 2 through 6. The need for greater accountability in the public sector is examined in Chapter 2 which provides the background for subsequent chapters. The general framework of management control and its importance to the public sector is considered in Chapter 3 which establishes the importance of budgeting and links planning with control. The theme of budgeting is extended in Chapter 4 where program planning and budgeting systems (PPBS) and zero base budgeting are dealt with. The discussion of budgeting is completed in Chapter 5, "Investment Appraisal," which focuses on the discounted cash flow methods of NPV and IRR of capital budgeting. Cost-benefit analysis is also considered and its appropriateness in the public sector is illustrated. Chapter 6 concludes the first major section of the book with a short introduction to the public sector audit function. The statutory basis of auditing relating to the central government, the national health service units, local governments, and nationalized industries in the United Kingdom is discussed and followed by an analysis of the expanded role of the auditor in the public sector.

Chapters 7 to 10 detail the activities of the central government, local government, national health service, and the nationalized industries in the United Kingdom, discusses how each type of governmental unit operates, and describes expenditure and revenue accounting. The book concludes by examining the concept of capital maintenance and the reform of the Westminster model of government accounting.

This work is intended for three main groups: (1) practicing accountants, (2) accounting students, and (3) public sector employees or officials not conversant with accounting issues. Because of the brevity of the text and the lack of any in-depth technical discussions, the book does not appear to be appropriate for the first two groups. However, for the reader who does not need to understand the technical aspects of public sector accounting, this is an excellent text.

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ROWAN JONES and MAURICE PENDLEBURY, *Public Sector Accounting*, Second Edition (London: Pitman Publishing, 1988, pp. x, 274, $12.95 paper).

The stated purpose of *Public Sector Accounting* is to provide a comprehensive and fully up-to-date examination of the special accounting issues concerning public sector organizations in the United Kingdom. The authors try to bring together accounting theory and practice from the areas of management accounting, financial accounting, and auditing. Consequently, the book is divided into these three distinct sections.

The authors attempt to set the framework in Chapter 1 by distinguishing the characteristics of public and private sector organizations. The discussion focuses on social, economic, political, and legal dimensions.

The first major section of the book begins with Chapter 2 which deals with management accounting and control issues and attempts to establish a foundation for the discussion of budgeting. The theme is set forth in the statement that "Planning is important. Controls to ensure the achievement of plans are important. The budget provides the essential link between the two processes" (p. 51). Chapter 3 addresses problems related to budget preparation process in the public sector, illustrates a typical timetable for the process, and concludes with a section on capital budgets. The concept of programming planning and budgeting systems (PPBS) is presented and critiqued in Chapter 4 using a comprehensive PPBS problem. Zero base budgeting is discussed in Chapter 5, and is followed by a chapter on cost-benefit analysis in investment appraisal decisions.

The second major division of the book examines financial accounting topics. To develop a theoretical foundation, issues such as the usefulness of financial reports, user groups, classifying nonprofit organizations, stewardship and accountability, objectives of public sector accounting, and ownership theories are discussed. Unfortunately, these topics are poorly presented and fail to articulate clearly a theory of public sector financial reporting.

Selected issues in financial accounting relating to the operating statements and balance sheets of public sector organizations are examined in Chapter 8. These include budgetary, cash, accrual, commitment, and fund accounting. However, these issues are treated at a very elementary level. Chapter 9 describes capital expenditure accounting in the United Kingdom and Chapter 10 is concerned with the legal and professional attempts to standardize financial accounting techniques. The usefulness of performance measures are also discussed and related to the stewardship concept.

The final section of the book discusses public sector auditing in the United Kingdom, showing how institutional and legal variables have contributed to the development of unique public sector auditing procedures. The text concludes with a detailed discussion of economy, efficiency, and effectiveness auditing.

While the book provides a good overview of public sector accounting topics, it does not provide sufficient depth to be recommended for students studying public sector accounting, especially in America.

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ROBERT W. MCGEE, *Accounting for Data Processing Costs* (New York; Westport, CT; and London: Quorum Books, 1988, pp. viii, 200, $39.95).

This book might best be divided into three parts: (1) reprints of various documents by the General Accounting Office (GAO) and National Association of Accountants (NAA) (Chapters 2, 3, 8, and the Appendix), and narrative of financial accounting rules for computer software by the FASB (Chapter 6); (2) taxation of computer software (Chapter 7); and (3) reprint of the result of an NAA funded survey on data processing chargeback practices (Chapters 4 and 5). In addition, a glossary of data processing terminology is included.

The first part contains reprints of "Guidelines for Accounting for Automatic Data Processing Costs (GAO, 1978) in Chapter 2, "Allocation of Service and Administrative Costs" (NAA Statement 4B, 1985) in Chapter 3, "Accounting for Software Used Internally" (NAA Issues Paper, 1985), in Chapter 8, and "Allocation of Information Systems Costs" (NAA Statement 4F, 1986) in the Appendix. Chapter 6 contains the narrative and interpretation of the financial accounting rules for computer software that covers the contents of such documents as FASB Statements No. 2, No. 6, and No. 86. We learn that the present financial accounting rules pertaining to computer software are unclear, for it appears that none of the FASB pronouncements details when computer software qualifies for capitalization treatment. Present practice of most companies includes expensing internally constructed software and capitalizing purchased software.

It may be a worthwhile exercise to bring together reprints of these documents about data processing costs and the author's interpretation of the financial accounting rules for computer software costs. But this reader is put off by the sequence of the reprints and the narratives. In my judgment, a logical sequence of these materials should be Chapters 2, 3, Appendix, and Chapters 6 and 8. In addition, the nature of the interpretations is highly procedural. There is no reference to any theory or model, and thus no assessment of the various pronouncements or how each improves upon the preceding ones.

The second part, on taxation on computer software (Chapter 7), contains narrative and interpretation of state and federal tax rules and some software tax cases. Basically, we are told that costs associated with the development of software can be either expensed as incurred or capitalized and amortized over five years or less, as are research and development costs for federal tax purposes. A considerable emphasis is then placed on the tax case controversies surrounding the tangibility issues of the "unbundled" software costs for state sales, use or ownership taxation, and the issues of the investment tax credit for federal taxation. But this focus is curiously incompatible with the intended focus of the book which is on the chargeback systems and management.

The third part (Chapters 4 and 5) reports the results of a survey with a 50 percent response rate of 450 firms to a questionnaire. The questionnaire focuses on data processing chargeback practices and management satisfaction with the systems. We learn, for example, that most companies (84 percent) have a policy for charging at least some portion of data processing operations and systems costs to users. Of these, 67 percent of the companies base their charges on some form of full costing, 22 percent on variable costing, and the remaining 10 percent use the profit center approach. We also learn that most of those surveyed are generally satisfied with their chargeback system, and that software projects and major hardware acquisitions are not usually planned more than a year or two in advance. But these results, as previously summarized in *Management Accounting* (June 1984), are largely descriptive and procedural. An integration of the results of the survey with a conceptual model for an effective chargeback system, and a discussion of the implications of the study for managers and academics would have been more interesting and informative.

While there have been very few, if any, books written in the emerging area of data processing cost accounting, I find this book to be highly procedural, jumbled, and overly descriptive. Some of the fundamental concepts that would elicit interest and stimulate further thought and study consist of the essential differences among software cost accounting, hardware cost accounting, and the operating cost accounting in terms of cost objectives, cost structure, relationships with job-order costing, R&D, and construction accounting. But these distinctions have not been emphasized. What we need are theories or conceptual models of the economic characteristics of data processing costs and their nature as assets, data processing cost management, and an effective pricing mechanism.

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CHARLES D. MECIMORE and JAMES K. WEEKS, *Techniques in Inventory Management and Control* (Montvale, NJ: National Association of Accountants, 1987, pp. x, 197, $18.95 paper).

The monograph, *Techniques in Inventory Management and Control*, has been prepared in response to four new developments in inventory management in the last 25 years:

1. Widespread computer applications in inventory management.
2. Use of Materials Requirements Planning (MRP).
3. Adaptation of Just-In-Time (JIT), KANBAN, and other inventory minimization techniques.
4. Changing roles of management accounting with regard to inventory management.

The objective in preparing this monograph was to "provide a more current presentation of inventory management techniques and applications" using several questionnaires and a small field study (14 companies, 63 plant accountants). While this broad objective has been achieved, the monograph raises many new interesting and critical research questions that could be addressed.

The monograph begins by inadvertently throwing down the gauntlet to conduct further research. The authors' research design was modified midstream as they became aware of "a rather new philosophy of inventory management . . . originating with Japanese companies, the Just-In-Time/Zero Inventory management philosophy or approach was being installed in many manufacturing companies" (p. 2). The authors then designed a new questionnaire and the field study component of the research design to accommodate these "new" philosophies. Unfortunately, they conducted no follow-up with nonrespondents to the original survey, having achieved only a 25 percent response rate (88/351).

Chapter 1 and both surveys use many undefined, and possibly confusing, terms. The glossary is only partially helpful in resolving these definitional questions. How can survey respondents provide accurate and comparable responses to very technical questions, e.g., cycle count, nomographs, ABC inventory analysis versus ABCD systems, time buckets, distribution requirements planning, etc., when concise definitions or examples are not provided? This reviewer questions the validity of the survey results because the respondents could attach different meanings to many of the key questions or terms. Their responses, therefore, may not be comparable.

The first survey also does not permit qualitative responses, even to such questions as "Do you use models in setting order quantities?" The responses are characterized only as formulas, nomographs, experiences, and others. The next logical question, or alternative question, would have been to indicate how they do establish inventory order quantities. These answers could have been used to validate or clarify the initial responses. Many respondents may use "formulas" or more complex decision models, without realizing the actual basis for the order quantities that are implemented.

Chapter 1 concludes with several unsupported assertions, not addressed until the final chapter and never supported by any of the data in the monograph or surveys.

1. "Many, if not most, of the companies use experience and intuition, which may be in-

ferior when compared with statistical methods in setting safety stock levels" (p. 4).
2. "These [JIT, KANBAN] systems are being implemented without the development of supporting financial accounting systems" (p. 6).
3. "Plant accountants are largely unaware of these [JIT, KANBAN] systems and the current cost accounting systems are lacking from an inventory management perspective in JIT/Zero Inventory environments" (p. 6).

The authors' methodologies and results do not support these assertions and the field studies conducted by this reviewer are in direct contravention to all three assertions. It is not clear that statistical models outperform experience and intuition. Many cost accountants are vitally concerned with developing supporting financial and accounting systems. The number of phone calls received from interested readers of this reviewer's two *Journal of Accountancy* articles (August, 1986; June, 1987) indicates a high level of concern about the integration of accounting systems with inventory management systems. Finally, to say plant accountants are "largely unaware" indicates academics may be largely unaware and most texts largely ignore these new developments in inventory management.

Chapters 2 and 3 of the monograph contain much of the same material on inventory management found in most cost accounting texts. The real contribution of this monograph is Chapter 4 which provides a very complete description of MRP systems. This chapter should be required reading for every cost accounting student. The remaining chapters summarize and interpret the authors' research results—findings that may be flawed by methodology and sampling bias.

The authors raise two additional and interesting research questions at the conclusion of the monograph: What is the impact of taxes on inventory management systems? How does LIFO or FIFO affect the decision to implement JIT or KANBAN systems? They assert additional taxes due may offset the initial advantages of using such systems (p. 151). Such tax issues would present no problems at the plant level but may be very material at the corporate level (p. 151). This intersection of research issues, tax and management accounting, demands further investigation. The authors raised these issues, *ex post*, but did not include them in their original research design.

On the whole, this would be an interesting book to assign for an advanced cost accounting course or for a seminar in management accounting. But it should not be assigned in the absence of other related materials, including current journal articles. It could also serve as a demonstration of survey research methods in a research methods course where students would be asked to conduct a critique and revision of the research design to achieve substantial improvements. The volume does not offer much insight for practicing management accountants or for firms wishing to investigate the desirability of JIT, KANBAN, or Zero Inventory systems.

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MICHAEL J. MEPHAM, *Accounting in Eighteenth Century Scotland* (New York and London: Garland Publishing, Inc., pp. 531, $90.00).

Professor Mepham's full volume assesses the status of accounting thought during a critical century of transition in modern Scottish history. His primary focus is the textbooks and instructional writings of four prominent teachers and practitioners (Alexander Malcolm, John Mair, William Gordon, and Robert Hamilton) whose careers spanned this period. Their collective efforts are historically significant because Scotland was then the leading English language center for publications of this type.

What is most refreshing is the author's placement of these developments in a broader historical context. Politically, this epoch saw the pacification of the Highlands and the formal merger of Scotland into the United Kingdom. Culturally, it was a period of such noteworthy advances in secular knowledge that is has been described as the "Scottish Enlightenment." Economically, it was the dawn of an industrial takeoff which would have wide-ranging ramifications for all of Western society.

These writings were important vehicles for communicating knowledge of the basic bookkeeping techniques first perfected in Italy during the fifteenth century. Central to all these works was the detailed explication of the tripartite Paciolian system of waste book, journal, and ledger. Most of these authors had become cognizant of this practice through contact with the business communities in the bustling ports of Holland. Besides the textbooks, knowledge of the "Italian Methode" was also disseminated in Scotland through formal pedagogy. Many authors served on the faculties of an emerging class of secondary academics whose curricula placed strong emphasis on the practical arts.

But Mepham also points out that these writers were also important innovators as well as perpetuators of established traditions. There were many evidences of their thoughtful modifications of this regime to accommodate unique contemporary needs. Several chapters, for instance, detail how these basic bookkeeping conventions inherited from the Renaissance were modified to the accounting requirements of estates, farms, general partnerships, tobacco and sugar importing, and linen manufacture.

Moreover, based on the rediscovery of the first edition of Robert Hamilton's *Introduction to Merchandise* (1778), Mepham argues that Scottish managerial accounting was much more sophisticated than previously believed. He devotes three chapters to explaining Hamilton's surprisingly advanced notions concerning process and joint costing, transfer pricing, profit centers, the measurement of residual income, and the returns earned by capital. This author's insights developed primarily through his contact with the relatively complex and large scale manufacture of linen. But the discussion of these matters was greatly abridged and, thus, lost to posterity in later editions. Doubtless, many of his ideas may have seemed irrelevant to contemporaries whose businesses were typically much less intricate than linen conversion.

Mepham also cogently explains how differing objectives distinguish eighteenth century accounting from modern practice. One major purpose was to promote "justice" or fairness in business and commercial dealing which was thought critical in assuring social order. These records became vital in commercial law. They were useful evidence, for instance, to attorneys charged with the duties of liquidating the estates of decedents and bankrupts and in the winding down of partnerships. Stewardship, on the other hand, though noted in texts dealing with estate management, was not emphasized as prominently as today. This is understandable because most businesses were small and lacked any significant degree of separation of ownership and control.

This study also demonstrates how the unique nature and structure of eighteenth century business practices shaped accounting in fundamental ways. This was particularly apparent in profit measurement. First, profits for Scotland's ubiquitous merchants were often measured at the close of important business transactions, such as the completion of a trading voyage, rather than at fixed time intervals. The primary exception to this pattern was in agriculture, where it was logical to close books periodically at the end of a growing season. Secondly, merchants generally maintained separate accounts for determining the profitability of individual ventures. Contemporary writers metaphorically describe this form of segment reporting as "branches" on the "tree of business." But unlike modern multidepartmental companies, there is little evidence of periodic consolidations to determine enterprise profit. Nor did contemporary system of public finance encourage periodization. There was no income tax in the United Kingdom until 1798 and the beginnings of the Napoleonic Wars. Instead, state funding derived from a combination of excise, personal property, and real estate taxes. Finally, lacking a compelling need for determining period income, these texts understandably place little emphasis on accruals or other types of estimates so fundamental to modern financial accounting.

In conclusion, this brilliant and wide-ranging study is highly recommended not only for specialists in accounting history, but also for more general students of this period interested in gaining insights into the concerns and outlooks of eighteenth century businessmen as revealed through contemporary accounting practices.

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/ PATTI A. MILLS, Translator, *The Legal Literature of Accounting: On Accounts by Diego del Castillo* (New York and London: Garland Publishing, Inc., 1988, pp. 120, $30.00).

Professor Patti Mills and the publisher are to be congratulated for this publication of a readable translation of an early Spanish legal treatise with accounting implications. Diego del Castillo, a Spanish jurist, published his *Tratado de Cuentas* in Burgos in 1522. There were further editions in 1542 and 1551. The present translation is of the 1551 edition, published in Salamanca. The translator has also provided an interesting scholarly introduction.

Historians of accounting have not devoted much attention to the law relating to the duty of agents (in the broadest sense) to account to their principals, to the "auditing" of accounts, or to the value of the contents of account books in courts of law. The neglect is perhaps not surprising if only because of differences among differ ent countries and business centers, and also over time. Professor Mills' book may inspire others to contribute to the existing small volume of systematic knowledge on these topics in the centuries before the coming of the corporation in the nineteenth century.

Del Castillo's treatise ranges widely and is, therefore, difficult to summarize. The scope of the work is perhaps best indicated by reproducing parts of some of the entries in the table of contents:

> who is obligated to render account
>
> how the account must be rendered
>
> what things have to be had in the account book so that it is ordered as it ought to be
>
> what things lend credence to the administrator's book and those that don't
>
> whether people must review and recount the account if it has an error
>
> until what date a request can be made that the account be examined again and reviewed if one of the parties says it contains an error.

In addition, there are observations on the work of the *contadores* who were charged by the courts to examine the accounts rendered (by agent to principal) "well and loyally" and "to guard and watch equally the rights of each of the parties without inclination." Professor Mills notes that the *contadores* were not professionals in accounting matters, and no qualification was called for other than a minimum level of competence.

BASIL S. YAMEY

DAN A. SIMUNIC and MICHAEL T. STEIN, *Product Differentiation in Auditing: Auditor Choice in the Market for Unseasoned New Issues*, Research Monograph Number 13 (Vancouver: The Canadian Certified General Accountants' Research Foundation, 1987, pp. x, 71, Can. $11.00 paper).

The purpose of this research monograph is to develop a theoretical framework and to conduct an empirical investigation of the auditor choice decision. The monograph meets, and exceeds, its objectives.

The authors defend the position that the audit services market is characterized by product differentiation rather than product homogeneity. Based upon the premise that the demand for audit services is derived from the objective function of the purchaser of the service (assumed to be the top management of the audited company), the purchaser fundamentally chooses a particular characteristic vector of value to top management, shareholders and creditors. According to the monograph, the primary differentiation characteristics of the audit product are the contribution of the audit to organizational control, the credibility of the auditor as perceived by shareholders and creditors, and the scope of the product line offered by the audit firm, in particular the availability of various management consulting services. Thus, audit firms seek to compete in the market for audit services by differentiating their product along these product dimensions.

Using the theoretical framework of differentiated audit services, the authors formulated six hypotheses concerning top managements' demand for the audit characteristics of control and credibility. In addition, since little is known about the demand characteristics for management consulting services, based upon reasonable conjectures, the authors identified three factors that may increase the probability that a company will demand management consulting services from its auditors. Finally, a seventh hypothesis was formulated concerning the effect of auditor choice on the value of the firm.

The empirical sections of the monograph tested these hypotheses and factors using a sample of initial public offerings (IPO). IPOs were selected because of the important decision point with respect to the auditor choice since the capital structure of the firm clearly changes. The results of the testing supported the control characteristic hypothesis concerning the increase in probability of a firm selecting a Big Eight auditor when a firm experiences increase in the control characteristics of size, complexity, and geographic dispersion. However, the empirical results concerning the audit characteristic of credibility and product line showed only weak (except for financial leverage, which was significant but in the wrong direction), but consistent, support. Finally, only weak support could be found for the effects of auditor choice on firm value. Thus, the monograph concluded that there was strong and consistent support (however, alternative plausible explanations were noted) for the internal agency cost rationale for auditor choice, and weakly consistent evidence for the external agency cost rationale for auditor choice. The somewhat mixed results of the empirical testing highlight the need for additional research in the important area of product differentiation and auditor credibility.

This monograph should be very beneficial to Ph.D. students and academicians who have an emphasis or interest in auditing research, especially to provide a foundation for the demand for auditing services. Audit practitioners would also find the monograph worth reading in order to enhance their awareness of the audit product, and to highlight the important characteristics sought by the purchases of audit services.

The monograph is very well written and thought provoking. It provides an excellent conceptual foundation for the demand for auditing, and also provides further evidence of increasing differentiation of the audit product.

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RICHARD VANGERMEERSCH, *Alexander Hamilton Church: A Man of Ideas for All Seasons* (New York and London: Garland Publishing, Inc., 1988, pp. 122, $30.00).

Alexander Hamilton Church, a writer and consultant during the early part of this century, was a contemporary of J. Slater Lewis, H. L. Gantt, and Frederick Winslow Taylor. Paul Garner, in his book *Evolution of Cost Accounting to 1925*, described Church as a leader among the American authorities in discussing the burden element of product cost. The book by Vangermeersch is the product of a more recent investigation into the writings of Church.

Church was born near London of American parents in the year 1866. In 1895 he began work for B & S Massey in Manchester, where he implemented a costing system that remained in use until 1960. In the early part of this century, Church came to the United States and worked as a consulting engineer first in Boston and later in New York. He died in 1936 in Massachusetts, alone and virtually a pauper.

In this book, Vangermeersch identifies 41 publications by Church between the years 1900–1934. The most important of these are reviewed in chapters three through six. These reviews describe Church's writings on manufacturing accounting, management, business and society, and industrial engineering. One of the most intriguing discussions is that of a published debate between Church and H. L. Gantt in 1915. This debate, hitherto unrecognized by historians, provides evidence of a controversy between the schools of thought by Church, on one hand, and by Taylor and Gantt on the other.

This book is a product of scholarly research, and is objectively written until the final chapter. In this chapter, Vangermeersch identifies 125 accounting "ideas" contributed by Church and evaluates their originality and value. If there is a weakness in the book, it is the lack of overall conclusions drawn from these ideas. Readers are required to read each of them and individually draw summary conclusions. Rather than summarize these ideas, the author concludes on more mundane issues, such as whether or not Church was a management accountant.

Vangermeersch closes with a discussion of the avenues for future research on Alexander Hamilton Church. It is clear that he regards this not as a definitive work, but rather one that adds to existing knowledge and encourages others to research in the area. The book is valuable as a tool for researchers in the history of cost accounting. For a more summary description that places Church in perspective with other writers of his time, the reader is referred to Garner's book.

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STEPHEN P. WALKER, *The Society of Accountants in Edinburgh 1854–1914: A Study of Recruitment to a Profession* (New York and London: Garland Publishing, Inc., 1988, pp. xi, 373, $45.00).

This is an important book which should be read by all scholars interested in the process of professionalization in public accountancy. Sponsored by the Institute of Chartered Accountants in Scotland (ICAS), Professor Walker's study analyzes the social backgrounds of all candidates who sought admission to the Society of Accountants in Edinburgh (SAE, one of three predecessors to the ICAS) during the period 1854–1914.

An extensive series of straightforward but, nevertheless, highly informative statistical analyses form the study's central core. The correlation of data for a wide range of social attributes provides a detailed profile of this early professional community. Moreover, the author amplifies his major findings by cogently blending into the narrative relevant, contemporary anecdotal material.

How does this survey add to our knowledge?

Walker departs from the conclusions of many earlier works in that he sees market factors as secondary in explaining the rapid growth of this professional body. Although his analysis is cognizant of the important connections between the accountants and Edinburgh's thriving commercial and legal communities, he argues that recruitment substantially exceeded practice needs. Growth, instead, seemed to be conditioned by three other factors. First, the SAE expanded aggressively to build its political power to counter the challenges in the courts and Parliament of rival groups, such as the Society of Incorporated Accountants and Auditors. Secondly, the substantial fees exacted by both masters and the association provided strong incentives to engage apprentices. Third, the infatuation of middle-class Victorian parents for their sons to pursue careers in "learned" professions rather than in "base" commercial pursuits, helped to assure a large pool of aspirants.

But these trends led to serious oversupply and an eventual diaspora of many chartered accountants to England, America, Canada, and other parts of the British Empire in search of outlets for their specialized skills. The glut continued until World War I when increased demand for accountants' services coupled with fall off in articling new apprentices due to national mobilization, temporarily brought supply and demand into better balance.

Another major question addressed was how accessible were careers (and by implication, the associated opportunities for status enhancement) in this profession to all elements in Scottish society. This emphasis seems to reflect a sensitivity to the criticisms of those social commentators who contend that organized professions are inherently elitist and undemocratic. Walker's conclusions, however, are neither as categorical nor as negative. He evaluated this issue through an extensive intergenerational analysis of all SAE candidates. Each was classified into one of nine categories defined by their father's occupation and social status (i.e., independent means, professions, manufacturers, commerce, farmers, distribution and processing, white collar, skilled manual, and semi- and unskilled manual). This revealed two patterns.

Until about 1870 several factors impeded the accessibility of members of the lower middle and laboring classes to entry into this professional body. First, high costs of apprenticeships and private secondary school education placed the less wealthy at a disadvantage in qualifying. Secondly, information about career opportunities were limited. It seems to have been most accessible to those whose fathers were either accountants or were consumers of their services. Thus, many early entrants were drawn from families connected with law and banking. Third, the SAE enhanced its image as a learned profession by raising its admission standards and, thus, persuaded many in the haute bourgeoisie that accountancy was a sufficiently "respectable" and prestigious calling for their sons.

After 1870, however, new circumstances emerged which substantially broadened the opportunities for the lower middle class candidates but not those of the laboring classes. First, an educational reform, the Endowed Institutions (Scotland) Act 1869, helped to reduce the costs of private school education. This made it possible for greater numbers of the less wealthy to prepare for professional qualifying examinations which after 1870 became increasingly theoretical. Secondly, the tendencies of the middle classes either to limit family size or to remain unmarried so as to maintain living standards, also reduced the pool of prospective entrants from these backgrounds. Third, the growing attractiveness of careers in other professions, such as law, drew off many of the more capable sons of Edinburgh's upper classes.

How might Walker's methodology be adopted for research into the development of the American profession?

Five modifications in classification and scope would seem appropriate. First, the basing of social categories primarily on occupation or economic strata, though useful in analyzing a homogeneous society like Scotland, might be modified to reflect America's greater diversity of ethnic, national, racial, regional, and religious backgrounds. Second, future research might also assess the impact that differences in the nature of practice and clientele exerted on recruitment patterns among the larger national firms and their more locally oriented colleagues. Third, this type of quantitative study might be fruitfully extended by greater reliance on the analysis of internal associational records such as the minutes of key policy setting committees. This could shed useful light on how the outlooks of professional leaders shaped decisions affecting recruitment. Fourth, future research on our nation's profession should focus on the more important role of the rising collegiate schools of business rather than secondary institutions. Finally, this study's extensive and in-depth analysis of social attributes might be most manageably applied to practitioner communities centered either in individual states or larger metropolitan communities for the much larger American profession.

In conclusion, this excellent study is highly recommended to all students of accounting history, not only for the new perspectives it provides of a pioneering professional community, but also for demonstrating how effective a well-defined statistical analysis may be in revealing the contours of the past.

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GREG WHITTRED, *The Evolution of Consolidated Financial Reporting in Australia* (New York: Garland Publishing, Inc., 1988, pp. vii, 183, $30.00).

This book, based on the author's Ph.D. dissertation, investigates the economic incentives of Australian corporations to voluntarily provide consolidated reports. The author combines a historical investigation of Australian institutional reporting requirements and evolution of capital markets with the methodology widely employed in those positive accounting studies which examine determinants of voluntary accounting choices. Such an approach can likely be used to study many other financial reporting developments, and provide interesting extensions to other historical studies.

Chapter 2 reviews the development of consolidated reporting in Australia, primarily in New South Wales and Victoria. The author determines financial reporting requirements in force over a period spanning 1925–1962. This is used to empirically identify companies that could be classified as voluntary consolidators, i.e., firms choosing to consolidate in the absence of regulatory requirements.

Chapter 3 reviews the development of Australian capital markets, particularly the use of public debt financing. The chapter argues that the demand for consolidated financial reporting can be traced to development of new modes of financing. A rationale for a three-way partitioning of consolidators is developed in the chapter.

Chapter 4 uses a positive accounting framework to develop determinants of management's choice of consolidated reporting as a monitoring solution. Hypotheses are offered for a situation where the borrowing company is a member of a group of companies. Contracting and monitoring solutions are offered for economic problems related to offering additional debt of the same or higher priority and non-arm's length transactions. In this section, I would have been interested to see the author elaborate on reporting for investments under the cost and equity method, since these methods do have monitoring implications. Similarly, contracting and monitoring solutions are offered for economic problems arising from separation of ownership from control in a situation where a company is a member of a "group of companies." Hypotheses developed for this latter situation ultimately prove untestable for lack of data.

Chapter 5 discusses research design and data collection procedures. Some consideration is given to the self-selection problem, which appears to be a frequent concern of reviewers in both capital market and positive accounting studies. The chapter includes a profile of the sample firms. As is usual in studies of this type, the author cannot obtain sufficient details of covenants contained in debt contracts. A leverage ratio is used as a surrogate in lieu of precise information about cross-guarantees.

Chapter 6 summarizes results. The author finds that consolidation is positively related to the presence of cross-guarantees and number of subsidiaries. There is an inverse relationship to management's share of equity.

Chapter 7 offers alternative hypotheses including those related to auditing firm and tax incentives. The final chapter provides a summary and conclusion. An appendix contains detail case studies.

This book can surely serve as a model for those researchers conducting positive accounting/historical research.

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NEW BOOKS: AN ANNOTATED LISTING

Editor's Note: As a general policy, books received but not reviewed in this or future issues will be annotated. There will be some exceptions.

K. N. BHASKAR, "An Accountant's Guide to Databases," *Accountants Digest No. 220*, Autumn 1988 (London: The Institute of Chartered Accountants in England and Wales, 1988, pp. 72, £8.50 paper).

Examines the basic concepts and terminology of database management and its implications for the field of accounting. Text begins with a brief introduction to current micro-technology and the organization of computer files and defines three distinctive meanings of the term "database" relevant to its use in accounting: the database in a microcomputer environment; the database as a comprehensive accounting software package on a mainframe computer; and the database as a theoretical definition used by computer scientists. Describes the development of data structuring as a means to achieve database objectives such as data independence, data integrity, and increased flexibility. Discusses first and second generation accounting models, their advantages and inefficiencies, and then considers two accounting systems recently developed to address the inadequacies of earlier systems: the database abstraction process and the Resources/Events/Agents model. The importance of an acceptable level of database security and integrity in an accounting database is also dealt with.

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DAVID W. E. CABELL, *Cabell's Directory of Publishing Opportunities in Business and Economics*, Fourth Edition (Beaumont, TX: Cabell Publishing Company, 1988, 3 volumes, pp. xxiv, 1436, $59.95 paper).

Includes listing of over 400 journals in the areas of business and economics. Each journal entry provides a description of the type of manuscript accepted, and whenever possible, a copy of the publication's manuscript guidelines, editorial policy, and objectives. Additional information includes demographics of the journals' readership, the editorial review process, acceptance rate, time required for review, availability of reviewer's comments, and whether fees are charged to review and/or publish manuscripts. Fourth edition expands substantially the number of journals and information on journals listed. Includes a table of contents alphabetized by journal name, and a classification of journals into different topic areas.

JAMES CUTT, *Comprehensive Auditing in Canada: Theory and Practice* (New York; Westport, CT; and London: Praeger Publishers, 1988, pp. 281, $45.00).

Study's purpose is the development of a theory and methodology for a comprehensive auditing model by examination of current theory and practice in the areas of auditing and policy analysis or program evaluation. The theory and methodology developed is designed primarily for the nonprofit component of the public sector but is extended to the profit component of the public and private sectors. Book deals with the model's applicability to activities of legislative auditors, Office of the Auditor General of Canada, and the provincial legislative auditors in Canada. Final chapter examines the effect of revisions in the Financial Administration Act on the control and accountability of Crown Corporations by and to Parliament.

JOHN D. FINNERTY, ANDREW J. KALOTAY, and FRANCIS X. FARRELL, JR., *The Financial Manager's Guide to Evaluating Bond Refunding Opportunities*, The Institutional Investor Series in Finance (Cambridge, MA: Ballinger Publishing Company, 1988, pp. 126, $34.95).

Basic introduction to bond refunding analysis. Explains the most widely accepted bond refunding methodologies and related controversies. First part of book outlines a general framework for evaluating the net advantage of refunding, including the accounting and tax impact considerations. Other topics covered include refunding high coupon debt and the impact of timing and the presence of a sinking fund. The text then deals with the refunding of low-coupon debt with high-coupon debt, and the special considerations related to a utility company's bond refunding when regulated rates include an allowance for debt. Book also contains a chapter on legal and in substance defeasance and adapts the bond refunding framework to the refunding of preferred stock.

John Finnerty is at College Savings Bank, Andrew J. Kalotay is with Salomon Brothers, Inc., and Francis Farrell is with Norstar Services, Inc.

K. P. GEE and R. H. GRAY, Editors, *The British Accounting Review Research Register 1988* (London, San Diego, New York, Berkeley, Boston, Sydney, Tokyo, and Toronto: Academic Press, 1988, pp. 332, $60.00).

Third edition of the biennial British Accounting Association's Research Register. The data presented in the volume, gathered from across 90 universities, polytechnics, and colleges, provides information on 1,072 accounting and finance academic staff members throughout the British Isles. The listing for each of the institutions includes the address, telephone number, and names of faculty with their qualifications and teaching specialisms, research interests, recent publications, and information on new courses offered. The book contains an index of names and a subject index divided into 16 categories. There is also a list of current research sponsored by professional groups.

INSTITUTE OF CHARTERED ACCOUNTANTS IN ENGLAND AND WALES, *Auditing and Reporting 1988/89* (London: The Institute of Chartered Accountants in England and Wales, 1988, pp. 1071, £12.95 paper).

The full texts of the UK auditing standards and guidelines. All UK auditing exposure drafts and other statements on auditing extant at September 1988. Provides auditors with guidance as developed by the Auditing Practices Committee (APC) up to September 1, 1988. Includes a summary of the history, membership, operation, and current work program of the APC; auditing standards and guidelines; Exposure Drafts in issue; and a number of the Audit Briefs. Also contains several other statements on auditing which were developed and issued by the Institute of Chartered Accountants in England and Wales and reprinted from Part III of the Institute's Members' Handbook.

INSTITUTE OF CHARTERED ACCOUNTANTS IN ENGLAND AND WALES, *Accounting Standards 1988/89* (London: The Institute of Chartered Accountants in England and Wales, 1988, £12.95 paper).

The full texts of all UK exposure drafts and accounting standards extant at August 1988. Presents all UK Exposure Drafts, Statements of Standard Accounting Practice, and Statements of Recommended Practice extant at July 31, 1988. The ASC's Handbook on Accounting for effects of changing prices is also included. Summarizes ASC's history, membership, operation, and text of relevant Technical Releases issued during the year.

RONALD W. MASULIS, *The Debt/Equity Choice*, The Institutional Investor Series in Finance (Cambridge, MA: Ballinger Publishing Company, 1988, pp. 141, $34.95 cloth, $14.95 paper).

Examination of theoretical and empirical research and writing on the study of capital structure with emphasis on the valuation effects of changes in corporate securities and leverage ratios. After considering benefits and costs to the corporation of corporate security sales, the advantages of various forms of debt, and how security prices react to changes in the firm's capital structure, book provides a historical analysis of aggregate corporate capital choices as a framework to discuss leverage ratios, security offerings, and sources of financing. Text then summarizes results of recent empirical research about market reaction to corporate investment, financing and dividend decisions, and examines tax consequences of the firm's capital structure and securities pricing. Other chapters deal with costs of bankruptcy and financial distress; debt/equity agency costs; stockholder-manager conflict of interest; information implicit in capital structure investment decisions; theory and evidence on subsidiary capital structure decisions; relation of the leverage choice to the characteristics of a firm, its common stock, and its industry; and interdependencies among dividend, investment, and financing decisions. Final chapter is a summary of the evidence and suggests avenues for future research.

Ronald W. Masulis is the James M. Collins Professor of Finance and an adjunct professor in the Department of Economics at Southern Methodist University.

PETER L. MCMICKLE and PAUL H. JENSEN, *The Birth of American Accountancy*, Foundations of Accounting Series (New York and London: Garland Publishing, Inc., 1988, pp. xxviii, 232, $35.00).

An annotated bibliography of 33, pre-1821, American accounting publications. Known printings of each work are listed and illustrations, including title pages of the first editions, are provided. Publications are also described by size and number of pages. The book was influenced by, and builds on, Harry C. Bentley and Ruth S. Leonard's comprehensive 1934 bibliography. Errors in the 1934 publication are corrected, and its listing expanded by including works with sections on bookkeeping, work by foreign writers, publications that were overlooked or incorrectly listed, and annotations on each work. Critical and explanatory remarks are intended to provide readers with a basis for understanding the origins of American accounting.

Peter L. McMickle is a Professor of Accounting at Memphis State University, School of Accountancy. Paul H. Jensen is an Instructor in Accounting at the University of Central Arkansas.

A. R. MONTAZEMI, *Information Systems in Small Business* (Hamilton, Ontario: The Society of Management Accountants of Canada, 1988, pp. 102, Can. $25.00).

Purpose is to explore the current use of information systems in the "small business" and to analyze the environmental factors that influence the design of such systems. Two-part study includes (1) an investigation of information systems environments based on 164 personal interviews with employees in 83 small firms, and (2) an assessment of the effects of eight organizational contextual variables on end-user satisfaction based on a structured questionnaire. By addressing issues related to factors influencing the choice of hardware and software, the level of end-user satisfaction achieved, and the character profile of the end user, the research seeks to reduce the discrepancies between the needs of the users and the system design and implementation. Five appendices describe the methodology and contain the statistics derived from the questionnaire.

A. R. Montazemi is a Professor at McMaster University.

NATIONAL HEALTH COUNCIL, INC., NATIONAL ASSEMBLY OF NATIONAL VOLUNTARY HEALTH AND SOCIAL WELFARE ORGANIZATIONS, INC., and UNITED WAY OF AMERICA, *Standards of Accounting and Financial Reporting for Voluntary Health and Welfare Organizations*, Revised Edition (New York: National Health Council, 1988, pp. 144, $40.00).

First published in 1964 to promote uniformity and consistency in accounting standards for nonprofit organizations. This edition incorporates recent developments in the area of health and welfare accounting resulting from efforts of the Financial Accounting Standards Board and relevant rulings and publications by the American Institute of Certified Public Accountants. Among the topics discussed are the recognition of "funds"; operating statements; classification and reporting of public support and other revenue; and classification and reporting of expenses. Eight appendices provide detailed information on the methods of expense allocation; special standards for fund-raising and fund-distribution activities of United Ways and federated fund-raising organizations; investment pools; transfer procedures for lapsing of term endowment fund restrictions; internal control over contributions; ratio analyses useful in assessing an organization's financial condition; the reporting of an agency's service efforts and program accomplishments; and accounting for joint costs of informational materials and activities that include a fund-raising appeal.

BARON PERLMAN, JAMES GUETHS, and DONALD A. WEBER, *The Academic Intrapreneur: Strategy, Innovation, and Manage-*

ment in Higher Education (Westport, CT: Praeger Publishers, 1988, pp. xii, 208, $39.95).

Examines the role of intrapreneurship in maintaining the strength and flexibility of institutions of higher education. Part I introduces the role of intrapreneurship in academe and discusses why intrapreneurship is important, what obstacles commonly cause intrapreneurs to fail, and what can be done to encourage their success within the organization. Part II addresses issues related to leadership of the intrapreneurial team and considers the intrapreneurs' ability to manipulate their environment. The effects of five organizational dimensions relevant to the intrapreneur are explored: technology, value, bureaucracy, organizational structure, and strategic types. Part III provides an extended case analysis of a major university's 14-year-old intrapreneurial effort and a personal history of the development of this intrapreneurial effort by one of its participants. Part IV analyzes the impact, effects of technology and culture, and lessons that can be drawn. Part V looks at the future of intrapreneurship in academe and introduces the concept of transpreneurial management, which is an organizational style that combines intrapreneurial precepts with a relatively stable environmental culture. The final section discusses the long-range effects of the intrapreneurial effort a decade after its implementation.

Baron Perlman is Professor of Psychology at the University of Wisconsin-Oshkosh. James Gueths is Administrative Vice President for Wisconsin National Life Insurance Company. Donald Weber is Director of the Office of Grants at the University of Wisconsin.

JEAN MARGO REID, Editor, *Law and Accounting: Nineteenth Century American Legal Cases*, Foundations of Accounting Series (New York and London: Garland Publishing, Inc., 1988, pp. xx, 221, $40.00).

Book contains edited versions of 53 nineteenth-century American legal cases in which courts discussed accounting issues. Many of the cases predate the earliest British court decisions on accounting matters. The cases concerned dividend law, computation of taxable income or remunerations under employee and leasehold profit sharing agreements, income determination for rate setting, and statutory reporting requirements for banks and other kinds of corporations. The cases show that government regulation of accounting predated the modern regulatory era; that sometimes, but not often, private contracts specified particular accounting treatment and that accounting, therefore, served to define private rights; that American courts discussed accrual accounting problems as early as 1837, and that a cash concept of profit was not the norm. As in the British court decisions during this period, the early American cases often contain inconsistent views on particular issues.

Jean Margo Reid is an attorney with Sanford C. Bernstein & Co., Inc.

ALAN C. SHAPIRO, *International Corporate Finance*, Second Edition, The Institutional Investor Series in Finance (Cambridge, MA: Ballinger Publishing Company, 1988, pp. 211, $34.95).

Using basic tools of financial analysis, book provides a framework for developing corporate strategies for foreign investment, financing, and operations. Looks at foreign exchange risk management via determinants of market equilibrium: purchasing power parity, interest rate parity, the Fisher and international Fisher effects, and forward rates as predictors of future spot rates. Discusses currency risk, its relation to inflation risk, and the measurement and management of exchange risk. Examines similarities and dissimilarities of working capital management in international and domestic firms including international cash management, accounts receivable management, inventory management, short-term financing, and managing intracorporate fund flows. Analyzes foreign investment, the measurement and management of political risk, and the impact of foreign operations on actual and perceived risk. Text also considers global financing strategy in terms of: (1) minimizing after tax financing costs, (2) limiting the risk of operating cash flows, and (3) achieving an appropriate worldwide financial structure.

Alan C. Shapiro is Professor of Finance and Business Economics at the School of Business Administration, University of Southern California.

GLENN G. SHEPARD and MARTIN K. STARR, *White Collar-Productivity Improvement Programs* (Morristown, NJ: Financial

Executives Research Foundation, 1988, pp. xi, 76, $5.00).

Study examines how 41 companies look at productivity improvement programs (PIPs) for white-collar employees. More than half of responding companies are in manufacturing with the others in finance/insurance, real estate, mining, construction, and service companies. Data were collected in a three-part questionnaire completed by: (1) senior management; (2) business unit managers; and (3) managers of PIPs. Part I of the questionnaire concerning top-management attitudes has questions relating to the comparison of efficiency and effectiveness in white-collar work and the relative importance of each, and the effectiveness of PIPs for white-collar workers. Part II contains demographic data grouped and analyzed by industry categories. Business unit managers ranked the PIPs in their units with respect to focus, results, and reasons for each program. Part III was completed by 35 of the 41 companies by the people who manage the actual PIPs for their company. Appendix A reproduces the questionnaire and Appendix B presents tabulated summaries to individual questions.

Glenn G. Shepard is a systems consultant in business operations and administration. Martin K. Starr is Professor of Production and Operations Management and Director of Columbia University's Center for Operations.

MILTON F. USRY, *Mary Ball Washington Forum Series in Accounting Education*, Volume IV Papers Presented February 1987-April 1988 (Pensacola, FL: The University of West Florida, 1988, pp. 62, free-paper).

Fourth volume in The University of West Florida's Mary Ball Washington Forum Series in Accounting Education. Volume contains five papers presented during February, 1987 through April, 1988. The first paper, "Preparing for an Accounting Career in the Forthcoming Decade," by James R. Boatsman, looks at how recent changes in the accounting firm's structure have led to a need for change in the education of future professionals. The next paper, "Setting a Utility's Fair Rate of Return," by Eugene F. Brigham, examines the movement of natural monopoly utility companies toward a competitive environment. The third paper, "Accounting Education: Critique from a New Perspective," by Arthur H. Doerr, recommends greater emphasis on broader and more diverse studies, in addition to technical professional training curriculum. Paper four, "The Health of Accounting Education," by Ralph L. Benke, questions the success and applicability of current methods of accounting education. The final paper, "Toward Government Accountability Through Financial Reporting," by James F. Antonio, examines the relations between various research studies on user needs and the measurement focus, as they relate to governmental accountability through financial reporting.

EMILE WOOLF and SURESH TANNA, *Understanding Accounting Standards* (London: The Institute of Chartered Accountants in England and Wales in association with the McGraw-Hill Book Company, 1988, pp. 440, £12.95 paper).

Sixteen chapters and three appendices provide accountants, practitioners, and others in related professions with a guide to the United Kingdom's current body of Statements of Standard Accounting Practice (SSAP). Explains rationale and mechanics of each SSAP and provides illustrations where appropriate. Principal issues relevant to each SSAP are discussed, alternative approaches to resolving problems raised by those issues are examined, and the preferred solution is explained. Questions at the close of each chapter are intended to increase the text's usefulness as a study guide for students.

Emile Woolf is a partner in Kingston Smith and Director of the EW FACT Accountancy colleges. Suresh Tanna is Joint Director of Studies on ACCA courses and Financial Director of the EW FACT Group.

Editor's Note: Heidi Cunnick assisted the editor in annotating these books.

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A. V. B. BROKE, "Time Limits for Claims and Elections," *Tax Digest No. 66*, Winter 1988/1989 (London: The Institute of Chartered Accountants in England and Wales, 1988, pp. 23, £6.50).

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JAMES CUTT, COMPREHENSIVE AUDITING IN CANADA: THEORY AND PRACTICE (New York; Westport, CT; and London: Praeger Publishers, 1988, pp. 281, $45.00).

KHOSROW FATEMI, Editor, *International Trade and Finance* (New York; Westport, CT; and London: Praeger Publishers, 1988, pp. xiii, 298, $49.95).

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Irving L. Janis, *Crucial Decisions: Leadership in Policymaking and Crisis Management* (New York: The Free Press, 1989, pp. 388, $27.95).

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by NOEL HEPWORTH

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FELLOWSHIP AWARD WINNERS

The American Accounting Association's Student Fellowship Committee met in Sarasota on May 10, 1989 to select the 1989-90 recipients of the American Accounting Association grants. The committee was chaired by Philip H. Siegel, University of Houston, Joyce Allen, Xavier University, and Herman Andress, Santa Fe Community College. The Fellowship Committee was authorized to grant $5,000 awards for 1989-90 to outstanding applicants based only upon academic merits. The Committee selections were based upon the applicants' attributes and accomplishments and were made without distinction as to the school at which the applicant would pursue the doctoral studies. The Committee reviewed fifty-seven applications and granted nine awards of $5,000 each. The Fellowship Award winners were:

Theodore Adam Bainbridge
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All members of the American Accounting Association are entitled to purchase publications listed at the member prices. Make checks or money orders payable to American Accounting Association. Orders for addresses within the United States will be mailed fourth class, postage paid. Orders going to destinations outside the United States and Canada will be sent by surface rate. In all cases, if special handling is requested, the costs will be assumed by the purchaser.

* Monographs Number 1, 2, 4, and 7 are out of print.

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JULY 1989 PLACEMENT ADS

The deadline for information to be included in the "Placement Information" section is two months prior to the date of publication. The Review *is published on the first day of January, April, July, and October. Placement advertising and replies should be sent to the American Accounting Association, 5717 Bessie Drive, Sarasota, FL 34233-2399. ATTENTION: ADVERTISING DEPT. All replies to box numbers should be on separate sheets to facilitate forwarding. There is no charge for this service to AAA members and associate members seeking employment. Others will be charged a fee of $150 per insertion. ADS SHOULD NOT EXCEED 150 WORDS.*

#301 UNIVERSITY OF NORTH TEXAS—ALL POSITIONS, TENURE-TRACK for the 1989–1990 year. Minimum qualifications: Ph.D. or DBA in Accounting (ABD considered if dissertation in process). Undergraduate and graduate level teaching. Salary is competitive. Send resumé to: Teddy L. Coe, University of North Texas, Department of Accounting, P.O. Box 13677, Denton, Texas 76203. UNT is an Equal Opportunity, Affirmative Action Employer.

#302 CPA, MBA seeking consultant position. Extensive experience in non-profit accounting and auditing. William Jacobs, CPA, 271 Stratton Road, New Rochelle, NY 10804.

#303 UNIVERSITY OF NEVADA, Assistant, Associate, or Full Professor with teaching interests in taxation, financial accounting, and/or managerial. These positions require a doctorate in accounting from an AACSB accredited school; Associate or Full Professor requires a record of teaching excellence and a record of recent and continuing research published in national refereed journals. A J.D. and LL.M. with accounting background will be considered for teaching in the tax area. Professional certification is desirable for all positions. ABD within one year of completion will be considered. Review of applications will begin immediately and continue until the position is filled. Preliminary interviews will be conducted at the national AAA meeting in Hawaii. Send resumé to: Duane Clary, Chair, Department of Accounting, College of Business and Economics, University of Nevada, Las Vegas, Nevada 89154. AA/EEO employer.

#304 CALIFORNIA STATE UNIVERSITY, SACRAMENTO has accounting faculty openings effective August, 1989, in its accredited AACSB undergraduate and master programs. Salary and rank open, commensurate with academic preparation and professional experience. For tenure-track positions, applicants must hold a doctoral degree with specialization in accounting; professional experience and/or certification are desirable. Primary emphasis is on teaching effectiveness; research and scholarly activities are required. Applicants in final stages of doctoral study may be considered for nontenure-track positions that may be converted to tenure-track if the doctorate degree is completed during the term of appointment. Send application letter and resumé to: Chair, Department of Accountancy, School of Business and Public Administration, California State University, 6000 J Street, Sacramento, CA 95819-2694. The Department will begin to review applications on Friday, September 30, 1988 until each position is filled. CSU, Sacramento is an Equal Opportunity/Affirmative Action/Handicapped/Title IX/Vietnam ERA Veteran Employer.

#305 ACCOUNTING FACULTY, EASTERN MICHIGAN UNIVERSITY. Eastern Michigan University, College of Business is located in a dynamic business environment, between Detroit and high-tech Ann Arbor areas. We are seeking motivated faculty holding doctoral degrees in accounting to fill tenure-track positions. Responsibilities include: teaching at the undergraduate and master's levels, advising students, doing research and writing, and taking part in professional development opportunities. Rank is dependent upon qualifications. ABD will be considered. Salary and benefits are very competitive. For consideration, send detailed resumé to: Position: ACCTG. Faculty, 310 King Hall—Human Resources, EASTERN MICHIGAN UNIVERSITY, Ypsilanti, MI 48197. (313) 487-3320. We take pride in the pursuit of our affirmative action objectives and encourage qualified women and minorities to consider this opportunity. Multicultural experience desired.

#306 MBA, CPA 21 years accounting experience, 12 years teaching, six years full-time SEEKS: Full-time tenure-track position, New York Metropolitan areas. A position which would not require doctorate for tenure. Box 319H, Scarsdale, NY 10583.

#307 LEHIGH UNIVERSITY invites applications for two tenure-track positions. Although preference will be given to applicants at the assistant professor level, candidates for associate professor who show evidence of substantial teaching and research productivity may also be considered. Candidates must have a Ph.D., D.B.A., or be near completion. We seek permanent faculty for the fall of 1990. We are also prepared to consider appointments for 1989-1990. While applicants' research and teaching interests may be in any area, we are especially interested in those concentrating in taxes, systems, and auditing. The Department seeks a balance between teaching performance and research productivity. Our undergraduate programs are fully accreditated, including Type A accounting accreditation, as is our MBA program. Applications received after November 15, 1989 cannot be assured of consideration. Contact Kenneth P. Sinclair, Chair, Department of Accounting, Lehigh University, Drown Hall, 35, Bethlehem, PA 18015. Lehigh is an Equal Employment Opportunity/Affirmative Action employer.

#308 APPLICATIONS FOR POSITIONS IN ACCOUNTING, at all professorial ranks, are invited from qualified persons. A Ph.D. is required. Demonstrated ability or potential for effective teaching and quality research are important considerations. The University of Pennsylvania is an equal opportunity/affirmative action employer. Interested persons should send their resumé including educational background, professional experience, publications, personal data, and, if applicable, a dissertation proposal and abstract to: Professor Robert E. Verrecchia, Accounting Department, University of Pennsylvania, Suite 2400 Steinberg Hall-Dietrich Hall, Philadelphia, PA 19104-6365.

#309 GEORGE MASON UNIVERSITY. The Department of Accounting and Business Legal Studies invites applications for assistant and associate professor tenure-track positions for Fall, 1990. Assistant candidates should have doctorate or be ABD near completion. Associate candidates must have a commensurate teaching, research, and service record. George Mason University is in the Washington, D.C. metropolitan area providing excellent research opportunities. The University is a dynamic, growing institution with 19,000 students. The School of Business Administration has 3,600 students and offers AACSB accredited undergraduate and graduate accounting degree programs. Applications should be sent to: Chair, Accounting/Business Legal Studies, School of Business Administration, George Mason University, 4400 University Drive, Fairfax, VA 22030. George Mason University is an Affirmative Action/Equal Opportunity Employer.

#310 ACCOUNTING: Lycoming College is seeking applicants for a full-time tenure-track position in Accounting. Ph.D. or D.B.A. preferred; CPA and Masters degree required. Evidence of teaching effectiveness with undergraduates expected. Rank and salary commensurate with qualifications. Submit letter of application, resumé, three letters of reference and transcripts to Mr. Richard Wienecke, Chairman, Department of Accounting, Lycoming College, Williamsport, PA 17701. Lycoming College is an Equal Opportunity Employer.

#311 FACULTY POSITION: Applicants are being sought for a tenure-track position in taxation accounting at Southwest Texas State University for Spring 1990, at Assistant/Associate Professor. Ph.D./D.B.A. in Accounting (or ABD) required. SWTSU is located near Austin and San Antonio in the Texas Hill Country. Salary is $40,000-$43,000. Send applications (resumé, transcripts, three letters of reference) to: DR. JAMES R. COOK, Department of Accounting, SWTSU, San Marcos, Texas 78666. Telephone (512) 245-2566. Closing date 9-15-89. The university reserves the right not to proceed with any appointment for financial or programmatic reasons. A REPRESENTATIVE WILL BE ATTENDING THE AAA MEETING AUGUST 14-17, 1989.

#312 ACCOUNTING PROFESSOR, FULL-TIME, tenure-track position. The Department of Accounting invites applications from those who have earned a doctorate in accounting, and have established a strong publications record, and have demonstrated competencies in teaching and service. Salary is commensurate with Texas averages for full professors. Texas Southern University is an urban state-supported university that enrolls over 7,000 students. The Jesse H. Jones School of Business is one of five divisions within the university. BBA, MBA, and MPA programs are offered. To apply for this position, send a resumé only plus the names and telephone numbers of three references to: Ladelle M. Hyman, Chairperson, Department of Accounting, Jesse H. Jones School of Business, Texas Southern University, 3100 Cleburne Street, Houston, TX 77004. Texas Southern University is an Equal Educational Opportunity Institution.

#313 OREGON STATE UNIVERSITY has openings for tenure-track faculty positions at the Assistant Professor level which will become available during the 1990–1991 academic year. Most interest areas can be accommodated, although preference will be given to candidates in financial and managerial. Responsibilities include quality teaching, research, and professional activities in the field of accounting. Candidates should hold the appropriate doctorate; professional certification is desirable. Salary is competitive, fringe benefits are excellent. Candidates should send a letter of application and resumé to: Charles Neyhart, Chairman, Department of Accounting, Oregon State University, Bexell Hall 200B, Corvallis, OR 97331-2603. Applications will be accepted until December 1, 1989. Oregon State University is an Affirmative Action Equal Opportunity Employer and complies with Section 504 of the Rehabilitation Act of 1973. Oregon State University has a policy of being responsive to the needs of dual-career couples.

#314 ELON COLLEGE invites applications for a permanent position as an Assistant or Associate Professor of Accounting, starting in August, 1990. Applicants should have a strong background, and interest in teaching courses, in Management Accounting. A doctorate and professional certification are desirable. Applicants with a master's degree and certification may be considered. While Elon has an MBA program, the primary focus of faculty effort is on undergraduate instruction in a liberal arts environment. The school is located near Burlington, N.C. between Greensboro and Durham. Contact: Professor Eugene Brooks, Love School of Business, Elon College, NC 27244, before October 1, 1989.

#315 VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY invites applications and nominations for the William S. Gay, L. Mahlon Harrell Professorships in Accounting and the Arthur Andersen Professorship in Information for Management. Applicants/nominees should have a demonstrated record of excellence in research and teaching. The appointments will be at the senior level with compensation and research supplements provided by the professorships. Applications will be accepted until September 1, 1989 or until the positions are filled. Applications and nominations should be sent to: Wayne E. Leininger, Department of Accounting, 3007 Pamplin Hall, Virginia Tech, Blacksburg, VA 24061-0101. Virginia Tech is an Equal Opportunity Affirmative Action Employer and encourages applications from all qualified individuals.

#316 BABSON COLLEGE invites applications for anticipated tenure-track accounting faculty positions at the assistant and associate professor levels to teach undergraduate/graduate courses in financial/managerial accounting. Doctorate is required, ABDs in final stages considered. Professional certification desirable. Babson places top priority on excellence in teaching, and encourages and supports applied research. Founded in 1919 and located 14 miles west of Boston in Wellesley, Massachusetts, Babson College is a coeducational institution of management. The college enrolls 1,500 undergraduates, 250 full-time MBA students, 1,400 part-time MBA students and offers a variety of programs in executive education. Qualified candidates should mail resumés to: Professor Michael L. Fetters, Acting Chairperson, Division of Accounting, Babson College, Wellesley, MA 02157. Babson College is an equal opportunity/affirmative action employer. Qualified women and minorities are encouraged to apply.

#317 THE UNIVERSITY OF TOLEDO. The Department of Accounting invites applications for positions in financial accounting, managerial accounting, and taxation, effective September 1989 or January or September 1990. Candidates should possess a doctorate with a specialty in accounting. Persons holding the combination of JD, MBA, CPA will also be considered for the tax position. Salary for the appointment is very competitive. The University of Toledo has an enrollment of approximately 20,000 students. The Accounting Department offers an undergraduate degree in accounting, as well as a Master of Science in Accounting degree, a Master of Taxation degree, and the MBA. Send vita to: Dr. Larry F. Konrath, Chairman, Department of Accounting, The University of Toledo, Toledo, OH 43606. Equal Opportunity/Affirmative Action Employer.

#318 CALIFORNIA STATE UNIVERSITY, LOS ANGELES is accepting applications from candidates for Assistant, Associate, and Full Professor tenure-track anticipated openings for 1990–1991. Tenure-track positions require a doctorate or ABD, except in taxation which requires a J.D. and MBT. Candidates should be able to demonstrate teaching effectiveness and research capabilities. The Department's needs are for persons who can teach financial accounting and auditing (undergraduate and graduate). California State University, Los Angeles is an Equal Opportunity/Affirmative Action Employer. Interested candidates are invited to submit their curriculum vitae to: Dr. Lynn Rans, Chair, Department of Accounting, California State University, Los Angeles, CA 90032. Please indicate whether you will be available for an interview at the AAA annual meeting in Hawaii.

#319 DEPARTMENT HEAD OF ACCOUNTANCY, School of Business, Ferris State University. Applications invited for the position of Accountancy Department Head for Ferris State University. Doctorate in Accountancy or appropriate doctorate with CPA, CMA, or CIA; and college teaching required. Administrative and business experience desirable. Twelve-month position available on or before July 1, 1990. Send application to: Professor Carolyn Thompson, Chair, Search Committee, Department of Accountancy, School of Business, Ferris State University, Big Rapids, MI 49307. (616) 592-2435. Screening begins October 1, 1989, but applications will be accepted until suitable candidate is identified. EQUAL OPPORTUNITY/AFFIRMATIVE ACTION EMPLOYER.

#320 NORTH CAROLINA STATE UNIVERSITY invites applications for a tenure-track position in accounting beginning in the fall of 1990. An earned doctorate is required, although advanced ABDs will also be considered at the Assistant Professor level. Important qualifications include demonstrated interest in and ability to do publishable research, and a commitment to teaching excellence. Please send resumé to: Paul F. Williams, Accounting Search Committee, Department of Economics and Business, North Carolina State University, Box 8109, Raleigh, North Carolina 27695-8109. North Carolina State University is an affirmative action/equal opportunity employer.

#321 WESTERN WASHINGTON UNIVERSITY invites applications for a tenure-track position in Accounting beginning Fall or 1990. Candidates must be a Ph.D., DBA, or ABD in final dissertation stage. A professional certification is desired. Salary and rank will be commensurate with qualifications and experience. Duties include teaching undergraduate and MBA courses, university service, and scholarly research. Western is a university of 10,000 students located in beautiful Puget Sound between Seattle and Vancouver, B.C. Please send letter of interest and vita to: Professor Ronald N. Savey, Chair, Accounting Department, Western Washington University, Bellingham, Washington 98225. AA/EOE.

#322 THE UNIVERSITY OF COLORADO AT DENVER seeks applications for faculty positions at the advanced Assistant, Associate, and Full Professor level. Qualifications include a doctoral degree and commitment to excellence in research and teaching. The College of Business on the Denver Campus has recently become an independent unit and has grown from a faculty of 10 in 1980 to over 35 research-oriented faculty members in the current year. Recruiting begins immediately and continues until the positions are filled. Contact Area Coordinator-Accounting, University of Colorado at Denver, College of Business, 1200 Larimer Street, Campus Box 165, Denver, CO 80204. The University is an Equal Opportunity, Affirmative Action Employer.

#323 THE UNIVERSITY OF UTAH SCHOOL OF ACCOUNTING is seeking qualified applicants for the position of Assistant/Associate/Professor of Accounting. Applicants should hold a doctorate or be in final dissertation stage. In addition to teaching responsibilities, all applicants are expected to perform scholarly research. Applicants with primary interest in financial accounting or information systems are urged to apply. Salaries are competitive and fringe benefits are excellent. Bachelor's, M.B.A., M.Pr.A., and Ph.D. programs are offered. Application deadline is December 31, 1989, or until position is filled. Send resumé to: Dr. Reed H. Randall, School of Accounting, Graduate School of Business, University of Utah, Salt Lake City, Utah 84112. An equal opportunity/affirmative action employer.

#324 TEXAS CHRISTIAN UNIVERSITY is accepting applications from candidates for an assistant professor (tenure-track) position. Qualifications include completion or near-completion of a Ph.D. or DBA degree and a strong commitment to high-quality teaching and research. Summer research grants are available for faculty engaged in scholarly research. Salary is competitive, and TCU pays 11½ percent of salary to TIAA-CREF. The Neeley School of Business is AACSB-accredited. Send vita to: Chairman, Department of Accounting, M. J. Neeley School of Business, Texas Christian University, Fort Worth, Texas 76129. TCU is an EEO/AA Employer.

#325 OAKLAND UNIVERSITY, Rochester, Michigan, is seeking applicants for tenure-track accounting faculty positions. Rank is open, based on qualifications and experience. Compensation is competitive, with superior fringe benefits. Minimum qualifications: PhD or DBA in Accounting (active ABDs will be considered); evidence of research competence and teaching effectiveness. Oakland, a state university with 12,000 students, is located 25 miles north of Detroit, Michigan. The School of Business Administration has 2,000 undergraduate and 300 MBA students. Undergraduate business and MBA programs are AACSB-accredited. Micro-computer work-stations in all faculty offices are networked through the School's VAX 8350 minicomputer. COMPUSTAT and CRSP are available. Send vita to: Dr. Gadis J. Dillon, Chairman, Department of Accounting, Oakland University, Rochester, Michigan 48309-4401. Oakland University is an equal opportunity, affirmative action employer.

#326 ACCOUNTING: Georgia College invites applications for a full-time tenure-track position. Candidates should have a doctorate in accounting (ABD will be considered). Teaching responsibilities include undergraduate and MBA accounting courses. Salary and rank commensurate with qualifications and experience. Georgia College has approximately 4,500 students and is located 30 miles northeast of Macon and 95 miles southeast of Atlanta. The college is an equal opportunity, affirmative action employer. Send letter of application, vita, official transcripts, and the names, addresses, and telephone numbers of three references to: Ms. Teresa King, Chair, Accounting Search Committee, School of Business, CBX 015, Milledgeville, GA 31061.

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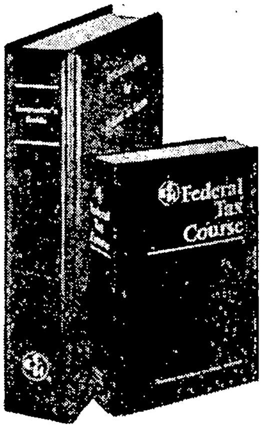

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When not in lists, numbers from one through ten should be spelled out, except where decimals are used. All others should be written numerically. Hyphens are preferred to the compounding or to the coining of words. Single authors should not employ the editorial "we."

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Porcano, T. M. "Distributive Justice and Tax Policy," THE ACCOUNTING REVIEW (October 1984a), pp. 619-636.

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1988 COMPETITIVE MANUSCRIPT AWARD

Did Firms Undertake Debt-Equity Swaps for an Accounting Paper Profit or True Financial Gain?

John R. M. Hand

ABSTRACT: This study examines the testable implications of two hypotheses for why firms undertook debt-equity swaps over the period August 1981-June 1984. The first hypothesis is that firms used the accounting-based reported earnings gain from the swap to smooth an unexpected and transitory decrease in their earnings per share. The second hypothesis is that a swap enabled the firm to relax potentially binding sinking-fund constraints in the cheapest feasible manner. Empirically, this study concludes that firms undertook debt-equity swaps for both reasons, but that swapping to smooth earnings was a much stronger motivation than swapping to relax potentially binding sinking-fund constraints.

DEBT-EQUITY swaps were a significant corporate finance tool of the early 1980s. Between August 1981 and June 1984 firms used them to retire approximately \$10.0 billion book value of long-term debt and issue in its place \$7.0 billion market value of equity. This paper addresses the question: Why did firms undertake debt-equity swaps? The testable implications of two hypotheses are examined, the first of which is explicitly accounting based.

The first hypothesis is that firms used the "paper" accounting earnings gain from the swap (hereafter, the swap gain) to smooth an unexpected and transitory decrease in their year-to-year quarterly earnings per share (EPS). I refer to this as the smoothing hypothesis and *ex post* consider it to be the more likely explanation. The hypothesis is tested using two definitions of smoothing, and over observable variables spanning both capital and noncapital market data. For example, with respect to noncapital market data, the smoothing hypothesis makes testable predictions concerning the time-series properties of EPS including versus excluding the swap gain and the timing

---

This paper is based on my dissertation completed at the University of Chicago in August, 1987. I extend sincere thanks to my committee: Bob Holthausen (Chairman), Peter Easton, Richard Leftwich, Merton Miller, Katherine Schipper, and Rob Vishny. I have also benefited from comments by Craig Ansley, George Foster, Tom Lys, Laurentius Marais, Ro Verrecchia, Pete Wilson, Mark Wolfson, and an anonymous reviewer.

John R. M. Hand is Assistant Professor of Accounting, Graduate School of Business, University of Chicago.

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of the swap relative to the end of the swapping firm's fiscal quarter. With respect to capital market data, it makes predictions about both the price level of those bonds swapped relative to bonds that the swapping firms did not swap (and bonds of a random sample of firms that did no swaps), and the relation between the swap gain and the change in the stock price of the swapping firm at the time of the swap announcement. The empirical results appear consistent with the smoothing hypothesis.

The second hypothesis is that swaps enabled firms to relax potentially binding sinking-fund constraints in the cheapest feasible manner, therefore providing a true financial gain. The "sinking-fund hypothesis" also yields testable predictions, spanning items such as the relative amount of sinking-fund debt issued by firms before versus during the period that swaps were undertaken, the characteristics of debt that was swapped versus debt that was not swapped, and the relative closeness of swapped sinking-fund debt to its sinking-fund constraints versus that which was not swapped. However, the data are only weakly consistent with these predictions. Some correlational tests were conducted to determine whether the motivations underlying the two hypotheses were complements, substitutes, or independent of one another. On this, the data yields no clear answer.

The conclusions are that firms undertook debt-equity swaps for both smoothing and sinking-fund reasons, but that swapping to smooth earnings was a much stronger motivation than swapping to relax potentially binding sinking-fund constraints. The remainder of the paper is organized as follows. The first section describes the institutional and legal background behind the emergence of debt-equity swaps as a popular tool of corporate finance in the years 1981–1984, and the second describes the data. The third section reports the tests of the various predictions made from the smoothing and the sinking-fund hypotheses, and a brief analysis of whether they were complements, substitutes, or independent of one another. The final section summarizes the findings and presents some concluding remarks.

I. Institutional and Legal Background

Prior to the Bankruptcy Tax Act of 1980 that became effective January 1, 1981, firms were able to realize the capital gain arising from repurchasing their debt selling at a discount to par in essentially a tax-free manner. Although under IRC Section 108 the firm had to recognize any difference between the nominal dollar value of the debt when originally sold and that when repurchased as ordinary income, the immediate tax liability created could be postponed almost indefinitely in most cases. Dyl and Spahr [1983] note that the old law allowed the firm to treat the difference between the face and the market value of the debt as ordinary income or to reduce the tax basis of assets by that same amount. Therefore, most firms simply reduced their bases in the stock of their subsidiaries, which were non-depreciable assets, and deferred recognition of any gain until those assets were sold. Those assets rarely were sold so the present value of the tax liability was effectively zero.

The Bankruptcy Tax Act altered IRC Section 108 by limiting the tax basis reduction to *depreciable* assets or to real estate held for sale in the ordinary course of business. This meant that to cancel the taxation on the realized capital gain arising from the difference between the face and the market value of the debt purchased, the firm had to reduce its depreciation tax shield. The Act therefore imposed significant costs on firms that wanted to retire debt selling at a discount, and in particular those firms with sinking-fund obligations to meet. Indeed, many viewed the passing of the Act as potentially crippling to a large segment of the corporate bond market [*Business Week*, 1981a].

In mid-1981 firms were presented with a way to avoid the effects of the Act; i.e., to avoid the tax penalty on retiring their debt selling at a discount to par. At that time Salomon Brothers developed the debt-equity swap. Prior to the Act the courts had long recognized an exception to the normal rule of income recognition, namely that if a firm undertook a recapitalization in which the debtholders accepted stock in exchange for their indebtedness, then any income caused by the discharge of indebtedness was tax-free [Faber, 1984]. Although the Act did not codify this stock-for-debt exception, it did recognize and confirm its presence obliquely; in Section 108(e)(8) the Act provided that the stock-for-debt exception would not apply only if nominal or token shares were issued. This exception was primarily motivated as a relief measure for firms in dire financial difficulties, but Salomon Brothers realized that it could also be made to apply to stock-for-debt swaps done by solvent firms.[1] However, there were several conditions which had to be met in order that the debt-equity swap made by a healthy firm be treated as a tax-free transaction. First, the bonds had to be acquired by a party unrelated to the issuer, a role fulfilled by an investment banker. Second, the acquiring party could not act merely as an agent for the firm; it had to act as a principal, taking on itself the risks involved in legally owning the bonds. And third, although the amount of stock issued needed not be identical to the debt exchanged in terms of market value, it had to satisfy IRC Section 108(e)(8) requiring that the amount of stock involved was not nominal or token. Thus, the stock side of the swap could not be satisfied with 100 percent cash.[2]

In a typical swap, the investment banker would approach a firm with a proposal illustrating the attributes of a swap. If the firm was interested, he or she would then buy the desired amount of debt in the open market on the bank's own account. Next, the firm would publicly announce the swap by means of a press release; then the investment banker exchanged the bonds for either newly issued or treasury stock (plus a cash component in some cases) with a total market value equal to the cost of the bonds he had purchased. The banker also received a commission which averaged 3.8 percent of the market value of the equity side of the swap plus a bond-holding fee which averaged $3.00 per $1,000 bond face value. For the investment banking community as a whole, fees amounted to approximately $250 million over the period August 1981–June 1984.

Since the firm's purchase of its debt satisfied the requirements of IRC Section 108(e)(8), it was not taxed on the difference between the face and the market value of the debt. The swapping firm, therefore, obtained a one-time accounting earnings gain for the swap quarter. The swap quarter was the fiscal quarter in which the swap was completed.[3] Since

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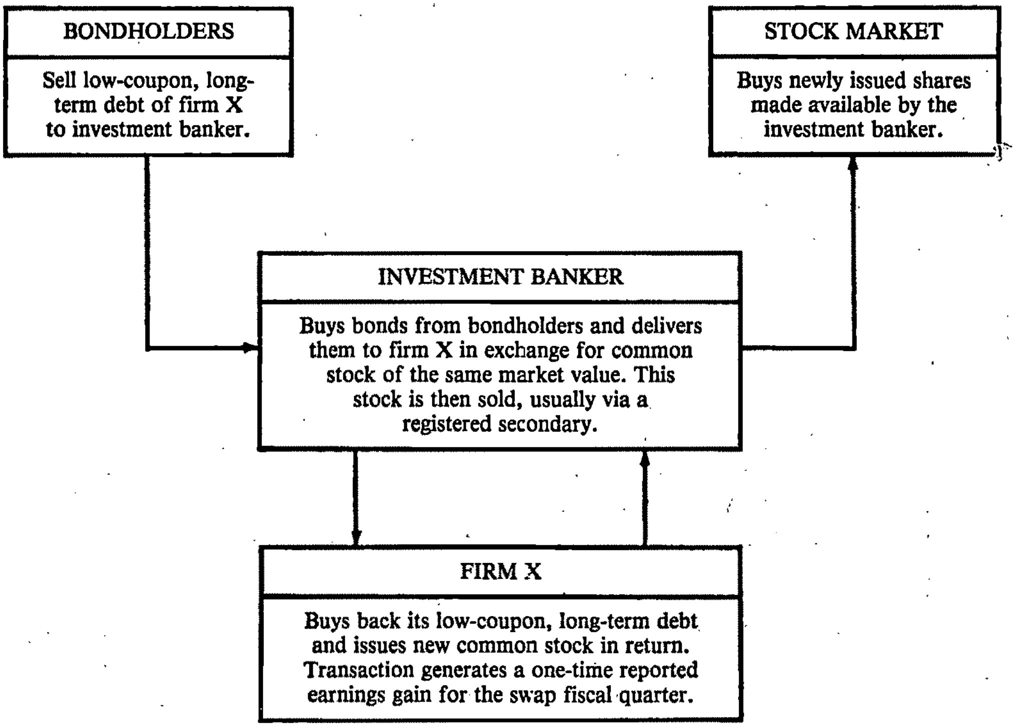
[1] "There it was," Mr. Foss (V.P. of Salomon Brothers and the man credited with inventing the debt-equity swap) recalls, "Fat, dumb and happy right in the middle of the bill" [Anders, 1982, p. 25].

[2] For the data described in the next section, 19 percent of swaps had a cash component to them. The median value of the cash component relative to the total size of the swap is 32 percent.

[3] The day that the swap was completed was taken to be the day on which the investment banker completed the

FIGURE 1
THE SEQUENCE OF EVENTS INVOLVED IN A DEBT-EQUITY SWAP


BONDHOLDERS
Sell low-coupon, long-term debt of firm X to investment banker.
STOCK MARKET
Buys newly issued shares made available by the investment banker.
INVESTMENT BANKER
Buys bonds from bondholders and delivers them to firm X in exchange for common stock of the same market value. This stock is then sold, usually via a registered secondary.
FIRM X
Buys back its low-coupon, long-term debt and issues new common stock in return. Transaction generates a one-time reported earnings gain for the swap fiscal quarter.

the swap gain was effectively the realization of a previously unrealized capital gain, it is referred to and treated as a "paper" gain. It was seen by the popular press as one of the most important benefits of the swap [Sloan and Spragins, 1981b; Hershman, 1981; and *Investment Dealer's Digest*, 1982]. Although some academic accounting literature has offered evidence that investors are able to see through such paper gains [Watts and Zimmerman, 1986], other research has reached different conclusions [Hand, 1989].

Once the firm had given the equity side of the swap to the investment banker, the investment banker was free to hold the stock for his or her own account or to sell it on the open market. The latter course was most frequently pursued, usually via a registered secondary offering. The median time between the swap announcement and this offering was two trading days. The sequence of events is summarized in Figure 1; it usually took no more than one to two weeks from the initial contact between investment banker and firm through to the registered secondary offering of the stock.

Two points are worth noting. First,

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sale of the registered secondary component of the equity side of the swap. For all but seven swaps the swap quarter was in the same fiscal quarter as the swap announcement itself; else the next quarter. For swaps where the equity side contained a cash component, the entire value of the swap was still relevant in terms of calculating the amount of the swap gain.

because the swap was tax-free only if the investment banker acted as a principal for his or her own account, it was not possible for the investment banker to agree to sell the bonds to the firm for a specified amount of stock before the investment banker had bought the bonds. If the banker had done so, the IRS would simply have ruled the transaction to be a repurchase agreement and the tax-free aspect of the swap would have been lost. However, once the investment banker had acquired the bonds, the two parties entered into an exchange agreement in which either the firm granted the investment banker the option of presenting the bonds to the firm in exchange for the stock several days after the agreement, or both parties entered a legally binding commitment with respect to the swap [Lipton, 1983]. In both cases the timing and the language of the swap agreement were crucial in maintaining the independence of the investment banker. Second, those firms which undertook debt-equity swaps appeared to realize that they were taking a chance with the IRS, in effect subjecting themselves to an "audit lottery" [Corporate Financing Week, 1985]. The IRS apparently did not like these transactions from their inception, feeling that solvent firms were abusing a provision designed for firms in dire financial straits.[4] There was, thus, a possibility at the time swaps took place that at a later date the IRS would enact a retroactive tax on the swap gain by changing the law *ex post* [*Business Week*, 1981b; Sloan and Spragins, 1981b; and Greene, 1984]. Recently, the IRS has nullified this possibility [*The Wall Street Journal*, 1987] so that there is now no likelihood of such a retroactive tax being enacted.

In July 1984 Congress passed the Deficit Reduction Act of 1984 (see Willens and Mirsky [1984] for details). The Act contained an array of provisions designed to respond to what were perceived as abuses to the tax code. Among these provisions was IRC Section 108(e)(10), which provided that an obligation satisfied by an issuance of stock was considered satisfied for money in an amount equal to the value of the stock. A debtor now realizes taxable income from retiring debt that is selling at a discount to par, and the tax can be avoided only if the firm makes an election to reduce the basis of depreciable property or realty held as inventory. The Deficit Reduction Act, therefore, made retiring debt selling at a discount to par by means of a debt-equity swap more costly in terms of taxes and transactions costs than a straight open-market purchase. The effective date of the provisions in the Deficit Reduction Act was July 18, 1984. Only two debt-equity swaps have been undertaken since that date as compared to 291 between August 1981 and July 18, 1984.

II: DATA

For reasons detailed in the previous section, debt-equity swaps arose in response to the Bankruptcy Tax Act of 1980 and ceased after the Deficit Reduction Act of 1984. This study is, therefore, able to draw on the entire population that occurred during that period. Information came from Securities Data Corporation and was cross-checked against the *Investment Dealer's Digest* and Moody's Industrial Manual.

These sources reported that 291 debt-equity swaps were completed in the years 1981–1984. A handful of swaps were announced but never completed. Those swaps that satisfied the following criteria were retained, with the number of observations eliminated from the initial population at each step because they failed to meet a given criterion given in parentheses:

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[4] But the IRS is known to be looking at the (debt-equity swap) technique with a cold, fishy-eyed stare. "They don't really like to hear of a technique blatantly touted as tax-free," confides one investment banker; "It embarrasses them" [McGoldrick, 1982, p. 203].

1. The firm's common stock was listed on the CRSP daily returns tape on and around the time of the first public release of information concerning the swap (19).
2. The swap was not announced concurrently with a separate issue of common stock (9). Asquith and Mullins [1986] have documented that the announcement of registered secondary equity offerings alone are on average associated with a two percent decrease in the price of the issuing firm's common stock. Including these observations could have biased any stock price change produced by the debt-equity swap *per se*.
3. The debt was exchanged for common and not preferred stock (6).
4. The date the common stock component was registered with the SEC was known (5).
5. All the debt acquired by the investment banker was U.S. dollar denominated (4).
6. The debt was not insubstance defeased (2). In an insubstance defeasance, risk-free securities whose cash flows match those of the defeased debt are placed in a trust (see Hand et al. [1989]).
7. The total amount of debt acquired by the investment banker was known (1).

After applying these criteria, 245 of the population of 291 swaps remained. Given that this represents 84 percent of the original population, the sample selection criteria are not expected to lead to any substantial selection bias problems in the upcoming empirical analysis.

The date of the first public release of information concerning the swap is taken to be the day that the common stock was registered with the SEC. The SEC registration dates were obtained from the Registrations and Offerings Statistics tape and cross-checked against the *Investment Dealers' Digest*'s Directory of Corporate Financing. In all but five cases the SEC registration date preceded *The Wall Street Journal* story date, if there was one, and for these five exceptions the two dates coincided. Of the 245 swaps, 75 percent had a story reported in *The Wall Street Journal*. The median number of days between the SEC registration date and *The Wall Street Journal* story was one day. Dunn [1985] notes that usually the firm issued a press release at the same time that it filed its registration documents with the SEC, and that this information was typically carried over the Dow Jones broad tape during trading hours. The SEC registration date is, therefore, chosen as the announcement day because a press release typically accompanied the registration. However, because the registration need not necessarily have occurred early enough in the day for the subsequent broad tape release to have been on the same trading day, the announcement "day" is taken to be the two-day window comprising the SEC registration date plus the next trading day, denoted $\langle 0,+1\rangle$.

Table 1 presents the distribution of the two-day swap announcement windows by calendar year and quarter, together with the distribution of the swapping firms by four-digit SIC industry classification and the investment bankers involved. The 245 swaps were done by 163 different firms and were well spread out

TABLE 1

GENERAL STATISTICS OF DEBT-EQUITY SWAPS

Distribution of Announcement Windows by Calendar Year and Quarter

Year:Quarter	*Number of Swaps*
1981:3	6
:4	28
1982:1	27
:2	39
:3	24
:4	18
1983:1	13
:2	25
:3	18
:4	18
1984:1	10
:2	19

Distribution of Swaps by Investment Banker Involved

Investment Banker	*Number of Swaps*
Salomon Bros.	63
Goldman Sachs	60
Morgan Stanley	38
First Boston	18
Lehman Bros.	12
Merrill Lynch	11
Others	43

Distribution of Swaps by Frequency

Number of Swaps	*Number of Firms who did this Number of Swaps*
1	104
2	40
3	16
4	2
5	1

Distribution of Swaps Industry Grouping

Industry	*4-digit SIC*	*Number of Swaps*
BHC's	6711	19
Retail	5311	13
Steel	3312	9
National Banks	6025	8
Petroleum	2911	8
Electric	3634	6
Pharmaceutical	2834	6
Motor V.	3711	6
Radio/TV	3662	6
Other		164

within the three-year period 1983:3–1984:2. The announcements were evenly spread over different days of the week, and also by fiscal and calendar quarter. For example, the percentage of swaps that were announced in the first through fourth fiscal quarters were 21.6 percent, 33.9 percent, 18.4 percent, and 26.1 percent; the corresponding figures for calendar quarters are almost identical. In particular, there is no evidence of a clustering of swap announcements in the fourth fiscal quarter. There is also little evidence of substantial industry grouping, although eight percent of swaps were done by bank holding companies.

Tables 2 and 3 present additional statistics describing other attributes of both the swaps and the firms which undertook them. Swapping firms were typically

TABLE 2

DESCRIPTIVE STATISTICS OF SWAPS AND THE SWAPPING FIRMS
(1981-1984)
(n=245)

Item	*Min.*	*Median*	*Mean*	*Max.*	*Std. Dev.*	*Stud. Range*
1. Swap size[1] ($million)	0.9	15.1	24.0	164.4	25.3	6.5
2. Total face value of debt swapped ($million)	1.1	21.1	33.1	197.5	34.6	5.7
3. Reported earnings gain from the swap[2] ($million)	−2.2[6]	4.8	8.9	87.3	11.4	7.9
4. Market value of common stock prior to the swap announcement[3] ($million)	65	942	2,437	27,982	4,419	6.3
5. Swap size as percent of market value of common stock prior to swap announcement	0.05	1.6	2.2	18.0	2.3	7.8
6. Swap size as percent of total liabilities[4] prior to swap announcement	0.02	1.2	1.9	18.7	2.5	7.6
7. Face value of long-term debt as percent of market value of common stock prior to swap announcement ($million)	2.0	50.3	77.0	839	92.3	9.1
8. Percent of change in leverage ratio[5]	−5.1	−0.5	−0.7	1.1	1.1	5.9

Data Sources: Standard & Poor's Corporation Stock Guide, Moody's Bank & Finance Manual, Moody's Transportation Manual, Moody's Industrial Manual, Standard & Poor's Daily Stock Price Record, The Investment Dealer's Digest's Directory of Corporate Financing, and *The Wall Street Journal*.

[1] [Number of common shares issued on offering date × price per share at which they were issued by the investment banker] + cash component if any.

[2] Face value of debt exchanged in swap − swap size.

[3] Total number of common shares outstanding at the end of the month preceding the SEC registration date × closing price of common stock at the end of trading on the day preceding the SEC registration date.

[4] Long-term debt (which includes funded debt, long-term bankloans, and deferred compensation) + current liabilities (defined for banks, investment trusts and insurance trusts, and finance companies as total deposits + short-term borrowings + accrued taxes).

[5] Leverage ratio is total liabilities (as in fn. 4 above prior to the swap; after the swap total liabilities are long-term debt + current liabilities − face value of debt exchanged in the swap) ÷ total assets. Total assets are defined as total liabilities + market value of common stock (defined as in fn. 3 above prior to the swap; after the swap defined as [number of shares of common stock prior to the swap + number of shares issued on the offering date] × closing price of common stock at the end of trading on the day after the SEC filing date).

[6] Four of the 245 observations had a negative reported earnings gain from the swap.

large; the median market value of common stock prior to the swap announcement places in the ninth decile of NYSE +AMEX firms over this period. The median swap size, that is to say the market value of the equity involved in the swap plus any cash component, was $15.1 million and was exchanged for a median of $21.1 million face value of debt. The median swap gain was $4.8 million which represented a median of 18 percent of earnings (including the gain) for the swap quarter. The median change in total leverage due to the swap was fairly small, being on the order of one half of one percent. Of bonds swapped, 85 percent had a sinking-fund provision and only six out of 449 bonds were fully retired in a swap.

TABLE 3
SUMMARY STATISTICS ON THE BONDS THAT WERE SWAPPED[1]
(1981–1984)

Item	Min.	Median	Mean	Max.	Std. Dev.	Stud. Range	Number of Valid Swaps
Number of bonds per Swap	1	1	1.9	9	1.4	5.8	233
Percent outstanding purchased	3.8	22.6	30.2	100	23.3	4.1	216
Percent coupon	3.75	8.1	8.0	14.25	1.7	6.4	233
Number of years to maturity	0.25	15.1	15.4	28.2	5.2	5.4	234

Type of Bond	Number of Bonds	Percentage
Sinking-Fund Debt—		
Debentures	358	80
Convertibles	15	3
Notes	9	2
Serial Debt	27	6
Other/No information	40	9
Total	449	100

[1] Each observation is an equally-weighted mean over the bonds that were swapped (except for statistics on the type of bond).

III. TWO HYPOTHESES: THEORY AND EVIDENCE

The Smoothing Hypothesis

The first hypothesis examined is that firms used the swap gain to smooth an unexpected and transitory decrease in their year-to-year quarterly EPS. The swap gain was the (almost always positive) tax-free difference between the face value of the debt swapped and the sum of the market value of the equity issued and cash component, if any. Although effectively a paper gain, it received substantial attention in the financial press. For example,

> For many companies, the boost to earnings is the main lure [Hershman, 1981].
>
> What's more, a swap produces an important by-product: a tax-free boost to earnings that amounts, notes Paul Kelly, executive vice president of Dean Witter Reynolds, to a valuable "income statement management device" [McGoldrick, 1982, p. 197].

A reasonable summary of the majority of the financial press' views of the swap gain (confirmed by discussions with two investment bankers whose firms arranged swaps) was that firms used it to manipulate or manage their reported EPS. That is, the firm saw a debt-equity swap as providing the benefit of having incremental control over the level of EPS for the swap quarter.

The notion that firms may use accruals or changes in accounting methods to manipulate or affect their earnings has received increased attention in the last few years.[5] Most research has assumed that direct or explicit accounting operations are used to effect earnings management. However, earnings management is also available through accounting "by-products" that arise from (changes in) a firm's financing and investment decisions, separate from direct accruals or changes in accounting methods. Such by-products can be considered as *indirect* earnings management techniques; in them a firm undertakes a financing or investment activity primarily for the accounting by-product it yields rather than the effect on the firm's wealth. By this criteria, a swap, although appearing to be a pure financing transaction, may rather have been an indirect method of managing earnings.

Within the more general class of earnings management, one possibility is that firms wished to *smooth* earnings per share.[6] Due to its imprecise nature, two alternative definitions of smoothing are considered. The first is: managing earnings so as to obtain an EPS number in the current quarter such that the time-series variance of the change in EPS including the current quarter is lower with the smoothing action than without it. The second is: managing earnings so as to obtain an EPS number in the current quarter that is closer to the market's expectation (formed prior to the announcement of the earnings management action) than without it.

The notion of firms smoothing earnings has typically speaking sat uneasily with theoretical work in accounting research. For example, Watts states that insofar as the general area of earnings manipulation is concerned,

> There is now a broad academic consensus, supported by extensive research conducted at the leading business schools, that the stock market is not systematically misled by accounting earnings. Prices are set, at the margin, by sophisticated investors who recognize the distortions of the accounting process [Watts, 1982, p. 10].

This perspective implies that smoothing is pointless because the marginal investor pricing the firm's securities is able to see through smoothing manipulations.[7] Smoothing, therefore, offers no benefit to shareholders. However, it is equally reasonable to note that an informal consensus exists among many practitioners and academics that managers *do* engage in efforts to smooth the time-series of accounting earnings. Thus, Watts also notes that companies display what appears to be an unwarranted concern with the effects of publicly reported accounting numbers and that corporate accountants devote much time and effort to massaging accounting data for public consumption. One reason for this behavior may be that management compensation is often linked to EPS [Healy, 1985]. Or, from the shareholders' point of view, an alternative reason, recently formalized by Trueman and Titman [1988], is that management may have an incentive to smooth EPS if such action causes the firm's claimholders to perceive a lower volatility for the firm's cash flows, thereby lowering the claimholders' demanded rate of return and raising the market value of the firm's common stock. Finally, occasional smoothing may be an effective way for a firm to provide the stock market with information as to the degree of future persistence in the unexpected component of current earnings [Miller and Rock, 1985; Easton and Zmijewski, 1987]. In particular, a one-time, revealed smoothing action by the firm can inform the capital market that this component has zero future persistence.

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[5] See the 1988 *Journal of Accounting Research* conference on the ability and incentive of management to affect the timing and impact of accounting earnings.

[6] Other possible types of earnings management might include maximizing managerial compensation [Healy, 1985], strategic behavior in labor disputes [Liberty and Zimmerman, 1986], or strategic behavior in management buyouts of public stockholders [DeAngelo, 1986].

[7] Hand [1989] rejects this null at the swap quarter's earnings announcement date.

Given these possibilities, here it is simply *assumed* that firms prefer smoothed EPS. There is no attempt to offer any direct empirical evidence as to why firms might find smoothing rational. Rather, the approach is simply to determine whether the data is or is not consistent with the testable implications that can be derived from the smoothing assumption.

Conditional on this smoothing assumption, I hypothesize that when debt-equity swaps were introduced in mid-1981, firms' abilities to smooth EPS increased in an unexpected and dramatic way. Prior to the development of the debt-equity swap, the set of instruments available with which to smooth EPS was fairly limited, with perhaps the major instrument on a continuing basis being the recognition and timing of discretionary items [Healy, 1985]. In contrast, swaps had several unique features associated with them from a smoothing point of view; most particularly, the tax-free swap gain. A swap could also be effected very quickly, usually taking between one to two weeks from inception to completion, and led to no settling-up next period in the manner that the recognition and timing of discretionary items did.[8] In addition, the financial press on the whole viewed swaps as economically a "super deal" due to their ability to "reduce swollen debt-equity levels," "enhance corporate client relationships," and "boost profits" [*Forbes*, 1981a; McGoldrick, 1982; *Investment Dealers' Digest*, 1982; and Hershman, 1981].

Over the period August 1981–June 1984, nominal interest rates were on average higher than the coupon rates at which most outstanding corporate debt had been issued. The mean nominal interest rate on AAA-rated debt over this period was 13.2 percent, the mean coupon of bonds that were swapped was 8.0 percent, and the mean coupon of bonds of a random sample of firms that did no swaps was 8.4 percent. Consequently, most corporate debt was priced at a substantial discount to par during the time that swaps were feasible. This meant that the impact on EPS available to firms considering a swap was positive rather than negative.

It is hypothesized that swaps offered firms a previously unavailable opportunity to smooth *transitory decreases* in EPS. It seems unlikely that firms used swaps to try and offset more permanent decreases in EPS because the tax loophole which was exploited to obtain the tax-free property of the swaps was not expected at the time to last forever [Meyer and Jetmore, 1982; McGoldrick, 1982; Institutional Investor, 1982; and Greene, 1984] and firms would eventually have run out of discounted debt to retire. Therefore, it would have been infeasible to have carried out swaps indefinitely so as to smooth a more permanent decrease in EPS. And if firms were using swaps to smooth a more permanent decrease in EPS, two predictions follow. First, no firm should ever do a single swap; and second, the swaps of those firms that undertook more than one

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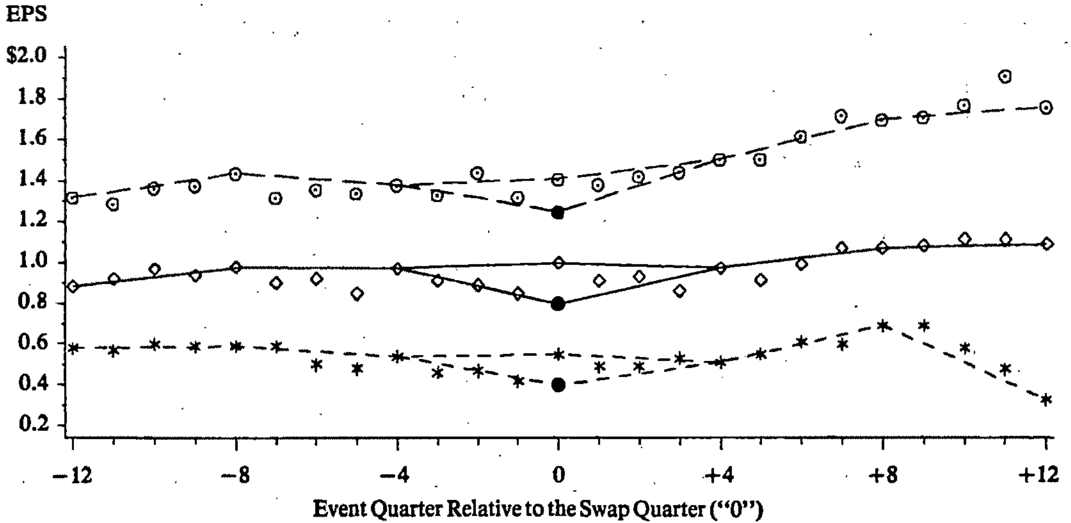
[8] Although they did have a small impact on future dividend and interest payments; the former through the dividend pool and the latter because the debt swapped was extinguished from the balance sheet.

FIGURE 2

TIME-SERIES COMPARISON IN EVENT-TIME OF THE 25TH, 50TH, AND 75TH PERCENTILES OF QUARTERLY EPS INCLUDING VERSUS EXCLUDING THE SWAP GAIN



Key: ✱ 25th percentile of EPS,
◇ 50th percentile of EPS,
⊙ 75th percentile of EPS,
● percentiles—Swap Gain.

swap should lie either in four quarters apart or in adjacent quarters (depending on whether the decrease in EPS was seasonal or not). From Table 1, 42.4 percent of swaps were one-time transactions; and of those that were not, 10.7 percent lay four quarters apart and 26.2 percent lay one quarter apart.[9] I interpret this as consistent with firms using swaps to try and offset a transitory rather than a permanent decrease in EPS.

Empirical Tests on the Time-Series of EPS in Event-Time

Let smoothing be defined as: managing earnings so as to obtain an EPS number in the current quarter such that the time-series variance of the change in EPS including the current quarter is lower with the smoothing action than without it. The hypothesis that firms used the swap gain to smooth an unexpected and transitory decrease in the time-series of EPS then leads to the following testable predictions.

1. The time-series of firms' EPS should exhibit a transitory decrease in the swap quarter when the swap gain is excluded from the swap quarter's EPS.
2. The time-series variance of the change in a swapping firm's EPS, in event-time centered on the swap quarter, should be lower when the swap gain is included in the swap quarter's EPS than when it is excluded.

On the first prediction, Figure 2 plots the time-series of the 25th, 50th, and 75th percentiles of quarterly EPS in event-time over a twenty-five quarter period centered on the swap quarter, denoted "0."[10] EPS are calculated as follows. Quarterly dollar earnings data (including extraordinary items and discontinued operations) were collected from the 1987 version of the COMPUSTAT 40-item tape and from *The Wall Street Journal Index*. These were then deflated by the number of common shares outstanding at the end of the month prior to the month in which the swap announcement was made, plus the number of common shares issued via the swap itself.[11] At each point in event-time a separate sort is done on EPS in order to obtain the percentiles, hence the 50th percentile of EPS does not necessarily belong to the same firm through event-time. The percentiles for event-quarters {−12, −8, −4, 0, +4, +8, +12} are joined by lines. For the swap quarter itself the 25th, 50th, and 75th percentiles of quarterly EPS excluding the swap gain are denoted by black circles.

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[9] The min/max and mean/median number of quarters spacing between multiple swaps were 0/10 and 3.3/3, respectively; $n=141$.

Before interpreting the data, consider two stylized empirical findings from the accounting literature. First, quarterly EPS are reasonably described as following a seasonal random walk [Foster, 1977], and second, the financial press focuses its attention on changes in *year-to-year* quarterly EPS rather than quarter-to-quarter quarterly EPS. Conditional on these stylized findings, the evidence in Figure 2 is consistent with the proposition that firms used the swap gain to smooth the time-series of year-to-year quarterly EPS. For all three percentiles reported, EPS in the swap quarter are much closer to EPS four quarters prior (and also four quarters ahead) if the swap gain is included than if it is excluded. Moreover, excepting quarter +12 for the 25th percentile data, quarterly EPS in the swap quarter when the swap gain is excluded are the lowest in the entire 25 quarter period. This evidence is thus consistent with the proposition that, in the aggregate, the time-series of year-to-year quarterly EPS would have transitorily decreased in the swap quarter had the swap not been conducted.[12]

However, since the same firm need not always be in the same percentile over time, the aggregate plots in Figure 2 may have low power. Tests were, therefore, also conducted at a more disaggregated level. First, I calculated the percentage of observations for which the year-to-year change in quarterly EPS between (a) the quarter one year prior to the swap quarter and the swap quarter, and (b) the swap quarter and the quarter one year subsequent to the swap quarter, belonged to the following groups: {−, +}, {+, −}, {+, +}, and {−, −}. The smoothing hypothesis predicts that when the swap gain is included in the swap quarter's EPS, the percentage of observations in the {−, +} group will equal that in the {+, −} group, which will equal 25 percent. This is because a successful smoothing operation should leave the smoothed time-series of EPS looking identical to a normal time-series of EPS.[13] If the swap gain is excluded from the swap quarter's EPS, the percentage of observations in the {−, +}

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[10] The median data together with other statistics on this event-time time-series are available from the author upon request.

[11] The number of available EPS numbers for each of event-quarters {−12, −8, −4, 0, +4, +8, +12} in Figure 2 were {245, 245, 245, 245, 233, 220, 201}, respectively.

[12] This and other conclusions in this section are robust to including as valid data only those swaps where the swapping firm had EPS data over the entire 25-quarter period.

[13] Twenty-five percent is slightly too large if the time-series of year-to-year quarterly EPS follows a random walk with a non-zero drift term. However, to obtain a number equal to 24 percent (only one percent lower) the drift term would need to be large enough such that the probability that next period's EPS is greater than this period's is either 0.60 or 0.40. The data are consistent with a probability equal to 0.57.

TABLE 4

TABULATION AND COMPARISON OF THE YEAR-TO-YEAR CHANGES IN QUARTERLY EPS FOR THE YEAR PRIOR TO THE SWAP QUARTER (EPS_{Q-4}) THROUGH THE YEAR SUBSEQUENT TO THE SWAP QUARTER (EPS_{Q+4}), INCLUDING VERSUS EXCLUDING THE SWAP GAIN IN THE SWAP QUARTER (1981-1984)

Percent of n=233 *where:*			
Group {−, +}=$EPS_{Q-4}>EPS_{Q0}<EPS_{Q+4}$		Group {+, −}=$EPS_{Q-4}<EPS_{Q0}\geq EPS_{Q+4}$	
Including Swap Gain	*Excluding Swap Gain*	*Including Swap Gain*	*Excluding Swap Gain*
24.9%	41.6%	28.3%	12.0%
($t_{difference=0}=-3.8$)		($t_{difference=0}=4.4$)	
$t_{25\%}$:		$t_{25\%}$:	
−0.1	5.9	1.2	−4.6
Group {+, +}=$EPS_{Q-4}\leq EPS_{Q0}<EPS_{Q+4}$		Group {−, −}=$EPS_{Q-4}\geq EPS_{Q0}\geq EPS_{Q+4}$	
Including Swap Gain	*Excluding Swap Gain*	*Including Swap Gain*	*Excluding Swap Gain*
33.0%	33.0%	13.7%	13.3%
($t_{difference=0}=0.0$)		($t_{difference=0}=0.1$)	

group should be >25 percent; in the {+, −} group <25 percent, and in the {−, +} group > in the {+, −} group.

Table 4 presents the empirical results of this test. Including the swap gain in the swap quarter's EPS, the percentage of observations in {−, +} is 24.9 percent (t-statistic for a difference relative to a null value of 25 percent $=t_{25\%}=-0.1$), and in {+, −} is 28.3 percent ($t_{25\%}=1.2$).[14] Excluding the swap gain from the swap quarter's EPS, the percentage of observations in {−, +} jumps to 41.6 percent ($t_{25\%}=5.9$) and that in {+, −} falls to 12.0 percent ($t_{25\%}=-4.6$). Including the swap gain in the swap quarter's EPS, the difference between the percentage of observations in {−, +} and {+, −} is −3.4 percent ($t=-0.8$).[15] However, when the swap gain is excluded, this difference increases to 29.6 percent ($t=7.2$). These results are favorable to the smoothing hypothesis.

Now consider evidence on the smoothing hypothesis when smoothing is instead defined as: managing earnings so as to obtain an EPS number in the current quarter that is closer to the market's expectation (formed prior to the announcement of the smoothing action) than without it. This definition predicts that swapping firms' EPS for the swap quarter, including the swap gain, will equal the market's expectation formed prior to the swap announcement. *Value Line* forecasts are used to proxy for the market's forecasts of EPS and it is assumed that *Value Line*'s forecast of the expected amount of any swap gain is zero.[16] At the aggregate level, the 25th, 50th, and 75th percentiles of *Value Line*'s forecasts made prior to the swap are \$0.50, \$0.95, and \$1.36 per share, respectively. Figure 2 shows that these numbers are much closer to the swap quarter's EPS if the swap gain is included than if it is excluded.

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[14] The t-statistic is the one-sample test statistic for a population proportion, given by $t=(\hat{p}-p_0)\div(p_0[1-p_0]/n)^{0.5}$, where $\hat{p}$ is the sample proportion and p_0 is the population proportion.

[15] This t-statistic is the independent samples test statistic for a difference between two poulation proportions, given by $t=(\hat{p}_i-\hat{p}_e)\div(2\hat{p}_c[1-\hat{p}_c]/n)^{0.5}$, where $\hat{p}_i$ and $\hat{p}_e$ are the sample proportions including and excluding the swap gain, and $\hat{p}_c=(\hat{p}_i+\hat{p}_e)/2$.

To test the same prediction at a more disaggregate level, the difference between EPS for the swap quarter, including the swap gain, and *Value Line*'s forecast was calculated. The smoothing hypothesis predicts that this difference will be zero. The mean difference was \$0.02 per share ($t=0.65$, $n=245$, 56 percent of individual differences >0); the median was \$0.04. Second, the difference between EPS for the swap quarter, excluding the swap gain, and *Value Line*'s forecast was calculated. The smoothing hypothesis predicts that this difference will be negative. The mean difference was $-$\$0.18 per share ($t=-4.9$, $n=245$, 67 percent <0); the median difference was $-$\$0.10. This evidence is consistent with the smoothing hypothesis.

Next, for each swap the time-series variance of the change in year-to-year quarterly EPS over event-time $t=\{-8,-4,0,+4,+8,+12\}$ was calculated, both including and excluding the swap gain. Of these variances, 58.4 percent were lower when the swap gain was included ($t_{50\%}=2.6$; $n=245$). Also, the difference in the adjusted R^2 from fitting the model $\text{EPS}_t-\text{EPS}_{t-4}=\text{constant}+\text{error}_t$ over event-time $t\in[-8,+12]$ including versus excluding the swap gain was calculated. Of these adjusted R^2s, 59.6 percent were higher when the swap gain was included ($t_{50\%}=3.0$; $n=245$). If instead the difference between the absolute values of EPS in the swap quarter and either *Value Line*'s forecast or EPS four quarters prior to the swap quarter were used as the smoothing metric, 64.9 percent and 70.6 percent of swaps had lower values of this metric including versus excluding the swap gain ($t_{50\%}=4.7$ and 6.5, respectively; $n=245$).

Finally, two diagnostic tests were performed to check the robustness of the results. First, the proposition that there was a transitory decrease in EPS in the swap quarter suggests that the decrease be a firm-specific and not a market-wide phenomenon. To test this, market-wide quarterly EPS for each event-time quarter were substituted in place of each firm's quarterly EPS number that generated the time-series shown in Figure 2. The data came from Standard & Poor's Security Price Index Record. The mean market-wide quarterly EPS for each event-time quarter were then calculated. The results are shown in Figure 3, where the market-wide means (denoted by pluses) are superimposed on the median firm-specific results from Figure 2 (denoted by diamonds). The market-wide data are scaled so that they are comparable to the firm-specific data. The scaling point is the median quarterly EPS from Figure 2 in the quarter four fiscal quarters prior to the swap quarter; that is, "-4" in Figures 2 and 3. Although market-wide earnings around the swap quarter appear to be a shade lower than usual, there is little evidence on the

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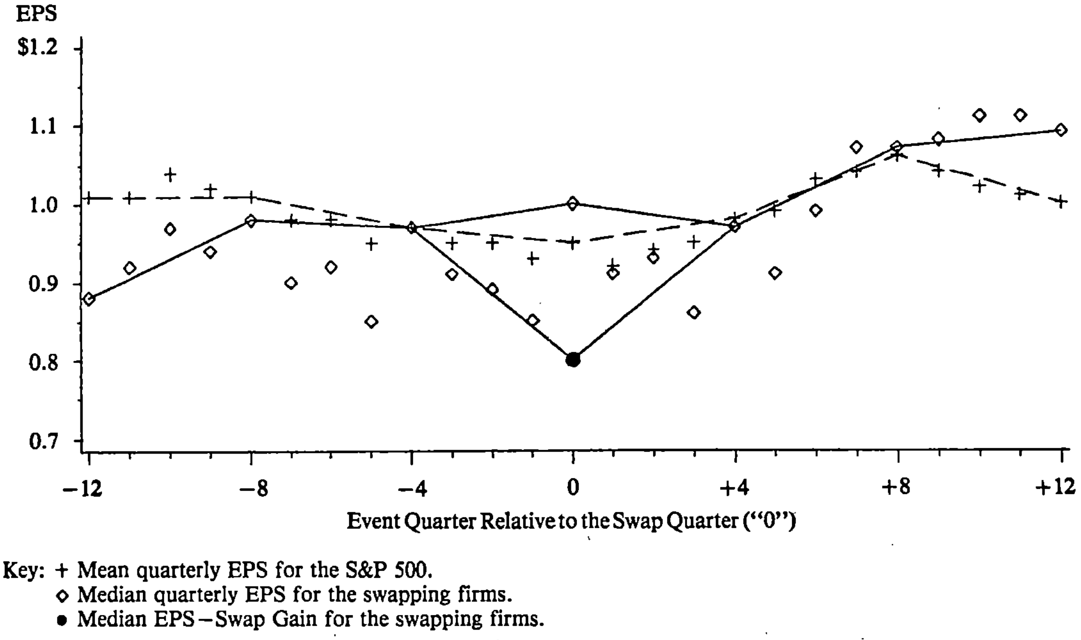
[16] This is reasonable given that on average 21 swaps were done in a calendar quarter. Twenty-one is a small number relative to the total number of firms on the NYSE+AMEX, indicating that the unconditional probability that any particular firm would undertake a swap in a given quarter is close to zero.

FIGURE 3

TIME-SERIES COMPARISON IN EVENT-TIME OF THE MEAN QUARTERLY EPS FOR THE S&P 500 AGAINST THE MEDIAN QUARTERLY EPS OF THE SWAPPING FIRMS INCLUDING VERSUS EXCLUDING THE SWAP GAIN



average of a decrease in market-wide earnings of the same magnitude as that experienced by the swapping firms.

Second, an alternative hypothesis for why firms valued the swap gain is that it enabled them to offset extraordinary items, such as write-offs. This alternative implies that the swap was not necessarily undertaken to offset an unexpected, one-quarter decrease in underlying cash flow. That is, while the smoothing hypothesis implies that the swap was undertaken to smooth an unexpected and transitory decrease in cash flow for the swap quarter, a swap undertaken to counteract a write-off need not have had any implications for cash flow. That is, a write-off can be an accounting recognition of a past event which the market is already aware of and has already reacted to. To test this, for each swap the earnings report for the swap quarter in *The Wall Street Journal* were examined to see if there were any extraordinary items reported, excluding the swap gain.[17] The 25th, 50th, and 75th percentiles for EPS including the swap gain but excluding these other extraordinary items were then $0.57, $1.01, and $1.41, respectively. The difference between these numbers and those given in Figure 2 where all extraordinary items are included is a maximum of $0.02 per share. The evidence is, therefore, inconsistent with the hypothesis that firms valued the swap gain because it enabled them to offset negative extraordinary items.[18]

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[17] The swap gain was identified in the quarterly earnings report in 51 percent of swaps. Only 18 percent of the reports detailed any extraordinary items, excluding the swap gain.

Empirical Tests on Bond Prices

If firms were using the swap to smooth an unexpected and transitory decrease in EPS, then they would have purchased the swap gain at the lowest possible cost. This implies that firms would have purchased those of their bonds that were lowest in price and which, therefore, provided the largest amount of swap gain per face dollar. Such a strategy minimized transactions costs for two reasons. First, transactions costs on the bond side of the swap were proportional to the face value repurchased. The lower the price of the bonds repurchased, the smaller the face amount that needed to be repurchased in order to obtain a given level of swap gain. Second, transactions costs on the equity side of the swap were proportional to the market value of the debt purchased (assuming for simplicity no cash component to the swap). The lower the price of the bonds repurchased, the smaller the market value of debt needed to be repurchased in order to obtain a given level of swap gain.

Table 5 reports statistics comparing prices of bonds that were swapped with prices of bonds of the swapping firms that were not swapped, and also with bonds of a random sample of 245 firms that did no swaps. Table 5 provides evidence on the prices of a random sample of firms that did no swaps since the smoothing hypothesis predicts that the mean price of bonds that were swapped should be less than that of bonds in the market as a whole. This is because under the smoothing hypothesis, all else held constant, swapping firms should be those for which the total cost of obtaining a given level of swap gain was lowest.

Bond data came from two different sources. First, daily price and volume data over the window $\langle -11, +10 \rangle$ were collected from Interactive Data Corporation on all bonds involved in a random sample of 199 of the 245 swaps. The price used, if there is one, is the last trade price prior to the swap announcement window $\langle 0, +1 \rangle$.[19] Second, "imputed" prices were calculated by discounting the scheduled coupon and principal repayments of each bond by the mean yield-to-maturity in the swap announcement month of industrial debt having the same Moody's rating.[20] This yielded a larger sample of bond prices.[21] Since a firm may have had more than one bond either swapped and/or not swapped, each observation in Table 5 is an equally-weighted mean of the relevant prices for that firm.[22]

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[18] Only extraordinary items in the swap quarter were examined. Therefore, the test ignores the possibility that the firm was (also) using other, less visible smoothing techniques.

[19] A trade price is defined as a price quoted by IDC for which IDC reports positive volume. The same statistics were also calculated using the first trade price after $\langle 0, +1 \rangle$. Almost identical results were obtained.

[20] Imputed prices were also calculated using yields-to-maturity covering all corporate debt rather than just industrial debt. This lowered imputed prices by an average of $1.2 per bond. The imputed prices reported in Table 5 use industrial rates for bonds that were swapped because few utilities undertook swaps, but corporate rates for bonds of the random sample of 245 firms that did no swaps. Ratings data came from the Moody's Manual that reported the financial results of the fiscal year prior to the fiscal year of the swap. The ratings are, therefore, an average of six months old.

[21] The two price series are correlated 0.83 for bonds that were swapped and 0.56 for bonds that were not swapped. The correlation is lower in the latter case because there a greater percentage of the bonds were convertibles than in the former case, although still few in absolute number. The calculation of the imputed price for the convertibles generated a few outliers; these did not substantially affect the mean prices but did substantially lower the correlation between trade and imputed prices. The evidence in Table 5 indicates that the imputed prices are on average reasonably unbiased.

[22] Data were collected from Moody's Manuals on a total of 2,535 bonds; 438 bonds that were swapped, 1,285 bonds of the swapping firms that were not swapped, and 812 bonds of the random sample of firms that did no swaps.

TABLE 5

COMPARISON OF PRICES OF BONDS THAT WERE SWAPPED WITH PRICES OF BONDS (1) OF THE SWAPPING FIRMS THAT WERE NOT SWAPPED, AND (2) OF A RANDOM SAMPLE OF 245 FIRMS THAT DID NO SWAPS (1981–1984)

	Bonds Swapped		*Bonds Not Swapped*		*Bonds of a Random Sample of 245 Firms That Did No Swaps*
Statistic ($ millions)	*Trade Price*[1]	*Imputed Price*	*Trade Price*	*Imputed Price*[2]	*Imputed Price*
Mean[2]	$65.8	$67.2	$82.0	$80.0	$74.8
Median	$64.3	$66.1	$82.4	$80.9	$75.2
Standard Deviation	$10.1	$10.7	$15.2	$14.0	$14.4
Number of obs.[3]	110	186	78	164	59
Percent of obs. >$100	1%	0%	17%	9%	3%
Number of Bonds per obs.:					
Mean	1.9	1.9	2.2	4.0	4.6
Median	2.0	1.0	2.0	3.0	2.0
Min./Max.	1/9	1/9	1/9	1/50	1/26

t-tests for Differences in Mean Prices

1. Paired-sample *t*-statistic between the mean trade prices of bonds that were swapped and bonds of the swapping firms that were not swapped $= -8.5$ (86 percent of individual differences <0, $n=49$). For imputed prices, $t=-10.0$ (80 percent of individual differences <0, $n=144$).
2. Independent samples *t*-statistic between the mean imputed prices of bonds that were not swapped and bonds of a random sample of firms that did no swaps $=2.4$
3. Independent samples *t*-statistic between the mean imputed prices of bonds that were swapped and bonds of a random sample of firms that did no swaps $=-4.3$.

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[1] Trade prices for bonds of the swapping firms came from IDC. They are the last trade price prior to the swap announcement window $\langle 0,+1\rangle$.

[2] The imputed prices were generated by discounting the coupon and principal repayments by the mean yield-to-maturity in the swap announcement month of industrial debt with the same rating (Source: various issues of Moody's Bond Record).

[3] Each observation is an equally-weighted mean across the bonds in that category for the participating firms.

Table 5 reports that the mean trade prices of bonds swapped versus bonds not swapped are $65.8 and $82.0, respectively. All prices are per $100 face value. The paired-sample *t*-statistic between these means is $t=-8.5$ (86 percent of the individual differences <0, $n=49$). For imputed prices the means are $65.2 and $80.0, respectively, and $t=-10.0$ (80 percent of the individual differences <0, $n=144$). These statistics are consistent with the hypothesis that the firm chose from amongst its outstanding bonds to swap those that were cheapest, and which, therefore, provided the greatest swap gain per face dollar, and at the lowest cost. Moreover, for the median imputed prices of the bonds of the swapping firms reported in Table 5, the ratio of transactions costs that would have been incurred if the bonds not swapped had been used to obtain the median swap gain of $4.8 million to actual transactions costs incurred using the bonds that were swapped is 2.1. There were, therefore, substantial savings to be achieved by using the lowest priced bonds, assuming the firm's objective was to maximize the amount of swap gain per dollar of transactions costs.

Table 5 also reports that the mean imputed price of bonds swapped is lower than that of bonds of a random sample of 245 firms that did no swaps; \$67.2 and \$74.8, respectively (independent samples t-statistic for a difference in these means is $t=-4.3$).[23] Finally, the mean imputed price of the bonds of the swapping firms that were not swapped is higher than that of the bonds of the random sample; \$80.0 and \$74.8, respectively ($t=2.4$).

In summary, the pricing results reported in Table 5 are all consistent with the proposition stemming from the smoothing hypothesis that the firm chose from amongst its outstanding bonds to swap those that were cheapest and that, therefore, provided the greatest swap gain per face dollar, and at the lowest cost.

Empirical Tests on the Face Amount of the Bonds Outstanding

An alternative implication of the hypothesis that firms sought to obtain a swap gain at the cheapest possible price is that the face amount outstanding prior to the swap should be greater for bonds that were swapped than for either bonds of the swapping firm that were not swapped, or bonds of a random sample of firms that did no swaps. The reasoning is that the larger the face amount outstanding, the greater the number of bondholders and, therefore, the easier it would have been for the investment banker acting on a firm's behalf to have purchased the bonds in the open market without unduly driving up their prices. Table 6 reports that the mean face amount outstanding of bonds that were swapped and bonds of the swapping firms that were not swapped are \$75.9 million and \$60.6 million, respectively ($t=4.6$, 60 percent of individual differences >0, $n=219$).

The mean face amount outstanding of bonds of the random sample of firms that did no swaps is \$23.2 million; the independent-samples t-statistics for a difference between this mean and the means of bonds swapped and bonds of the swapping firms that were not swapped are $t=8.5$ and $t=10.7$, respectively. The latter statistics suggest that one reason why it was typically the case that larger firms did swaps is simply that larger firms have more and bigger issues of debt outstanding. The median swapping firm placed in the ninth decile of NYSE +AMEX firms, whereas the median firm from the random sample of firms that had no swaps placed in the fifth decile.[24] Also, the mean (median) number of bonds for which there was data on either the coupon, amount outstanding, or date of maturity are 7.4 (five) for bonds of the swapping firms and 3.3 (two) for bonds of the random sample of firms that did no swaps. Overall, this evidence too is consistent with the hypothesis that the firm chose to swap those bonds that yielded a given level of swap gain at the cheapest price. It is, therefore, also consistent with the smoothing hypothesis.

Empirical Tests on the Timing of the Swap

If firms were using the swap gain to

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[23] The random sample was chosen as follows. For each swap announcement date, the CRSP daily master file was searched at random. If a firm was found whose stock was traded over the $\langle 0, +1 \rangle$ window for that swap, it was chosen. Sampling was without replacement and a firm was excluded if it had done or would do a swap, or if it was not covered in any of Moody's Manuals. Approximately one in every three randomly selected CUSIP numbers satisfied these requirements.

[24] Moreover, the structure of transactions costs on the equity side of the swap made a swap relatively much more expensive for the smaller firm (see Smith [1977]).

TABLE 6

COMPARISON OF THE FACE DOLLAR AMOUNT OUTSTANDING PRIOR TO THE SWAP ANNOUNCEMENT OF BONDS THAT WERE SWAPPED WITH BONDS (1) OF THE SWAPPING FIRMS THAT WERE NOT SWAPPED, AND (2) OF A RANDOM SAMPLE OF 245 FIRMS THAT DID NO SWAPS (1981–1984)

Statistic (\$ millions)	*Bonds Swapped*	*Bonds Not Swapped*	*Bonds of a Random Sample of 245 Firms That Did No Swaps*
Mean	\$75.9	\$60.6	\$23.2
Median	\$58.4	\$47.3	\$13.0
Standard Deviation	\$58.6	\$50.9	\$34.1
Min./Max.	\$5.4/\$300	\$1/\$279	\$0.2/\$250
Number of obs.[1]	226	226	179
Number of Bonds per obs.:			
Mean/Median	1.9/1	5.5/4	3.3/2

t-tests for Differences in Mean Face Dollar Amounts Outstanding

1. Paired-sample t-statistic between the mean face dollar amount outstanding of bonds that were swapped and bonds of the swapping firms that were not swapped = 4.6 (60 percent of differences > 0, $n = 219$).
2. Independent samples t-statistic between the mean face dollar amount outstanding of bonds of the swapping firm that were not swapped, and bonds of a random sample of firms that did no swaps = 8.5.
3. Independent samples t-statistic between the mean face dollar amount outstanding of bonds that were swapped and bonds of a random sample of firms that did no swaps = 10.7.

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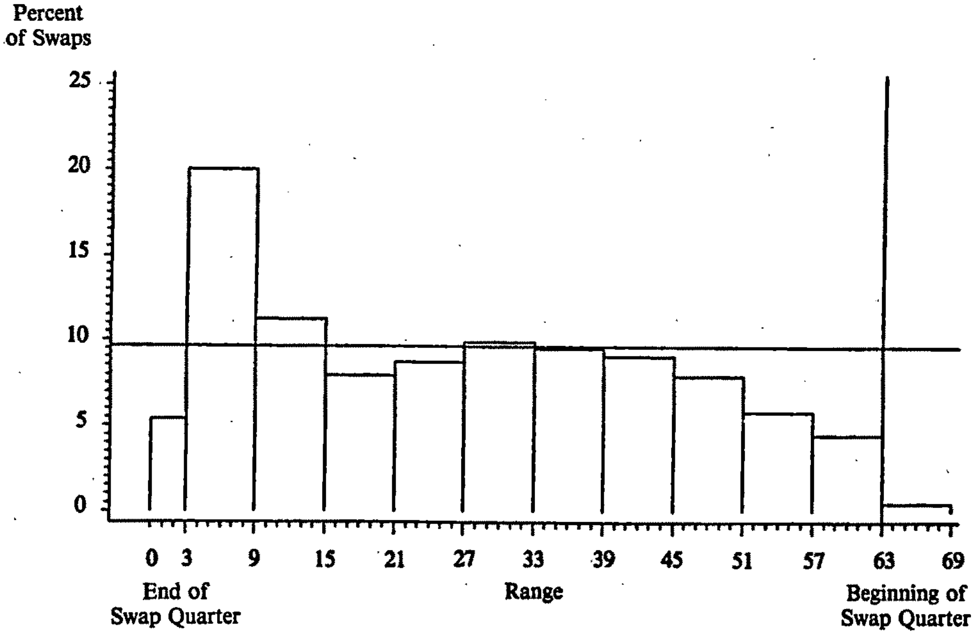
[1] Each observation is an equally-weighted mean across the bonds in that category for the participating firm.

smooth out an unexpected and transitory decrease in their EPS, then they would have had the most precise assessment of the nature and magnitude of the decrease later rather than earlier in a quarter. This then implies that firms would have undertaken swaps more towards the end rather than the beginning of a quarter.

Under the null, the distribution of swap completion dates should peak close to the end of the swap quarter, and there should also be relatively few swaps completed at the very beginning of the swap quarter. The day the swap was completed was defined as the day that the investment banker undertook the sale of the registered secondary. The median length of time between this day and the swap announcement was two trading days; for 75 percent of swaps the time was four days or less. For all but six of the 245 swaps the swap quarter was in the same fiscal quarter as the swap announcement itself; else it was the next fiscal quarter.

Figure 4 presents the empirical distribution of the number of days between the end of the swap quarter and the swap completion date. Figure 4 is consistent with the null hypothesis; the distribution peaks closer to the end than to the beginning of the swap quarter, and fewer swaps were completed at the very beginning of the swap quarter. The χ^2-statistic testing whether the distribution in Figure 4 is different from a uniform distribution is 16.7 (ten degrees of freedom; $p = 0.085$).

FIGURE 4
HISTOGRAM OF THE NUMBER OF DAYS BETWEEN THE SWAP COMPLETION DATE AND THE END OF THE SWAP QUARTER



Notes: Horizontal line is the expected percent of swaps per range if swaps were completed randomly through time. Vertical line is the typical number of days in a fiscal quarter (=63).

Empirical Tests on the Private Information Conveyed by the Swap Gain

This section describes and tests a hypothesis linking the swap gain to the two-day swap announcement common stock prediction error. It is hypothesized that, all else held constant, the abnormal common stock return due to the swap announcement will be the negative of the swap gain, multiplied by the probability that at the swap announcement the market believed that the firm was using the swap gain to smooth its earnings. This prediction follows from the assumption that at the swap announcement the capital market was repricing the firm's common stock based on the smoothing hypothesis, but probabilistically so.

As under the smoothing hypothesis firms used the swap gain to smooth an unexpected and transitory decrease in quarterly EPS, the swap announcement would have conveyed previously private information to the capital market. This information was that earnings for the swap quarter would be unexpectedly down by a one-time amount equal to the swap gain, since it was this decrease that the swap gain was designed to offset. Hence, if the market knew for certain that the swapping firm was using the swap to smooth its earnings, it would have downwardly repriced the swapping firm's common stock by the amount of the swap gain.

However, it is reasonable to suppose that in fact the market did *not* know for sure which firms were swapping for smoothing reasons, and which were swapping for other reasons (such as to relax potentially binding sinking-fund constraints, discussed more in the next section). In that case, all else held constant, the market would have downwardly repriced the swapping firm's common stock by the swap gain multiplied by the probability that at the swap announcement the market believed that the firm was using the swap gain to smooth its earnings. Although the exact amount of the swap gain was not always exactly determined until the swap was completed (a median of two trading days past the swap announcement), it could be closely and rationally estimated by information given in the press-release.[25] Therefore, given a proxy for the probability that the firm's motivation in undertaking a swap was to smooth an unexpected and transitory decrease in EPS, the link between the swap gain and the market's reaction to the swap announcement can be empirically assessed.

Model of the Returns Generating Process

The test of this prediction is structured within the following model of the returns generating process. Let w be the two-day event-window $\langle 0,+1\rangle$, where $\langle 0\rangle$ is the SEC registration date of the equity side of the swap. The behavior of two-day continuously compounded returns $\tilde{R}_{it}$ for each common stock $i\in[1,245]$ in event-time t after and on w is taken as:

$$t>w: \qquad \tilde{R}_{it}=\alpha_i+\beta_i\tilde{R}_{mt}+\tilde{\varepsilon}_{it} \qquad (1)$$

where:

$$\tilde{\varepsilon}_{it}\sim indep\ \mathrm{N}\ (0,\sigma_i^2),$$
$$\mathrm{cov}(\tilde{\varepsilon}_{it},\tilde{R}_{mt})=0\ \forall\ i,t.$$

$$t=w: \qquad \tilde{R}_{it}=\alpha_i+\beta_i\tilde{R}_{mt}+\tilde{\delta}_i+\tilde{\varepsilon}_{it} \qquad (2)$$

where:

$$\tilde{\delta}_i=\sum_{j=1}^{J}a_jX_{ij}+\tilde{\eta}_i,$$
$$\mathrm{cov}(\tilde{\eta}_i,\tilde{\varepsilon}_{kt})=0\ \forall\ i,k,t,$$
$$\tilde{\eta}_i\sim iid\,\mathrm{N}(0,\sigma_\eta^2),$$
$$\mathrm{cov}(\tilde{\eta}_i,\tilde{R}_{mt})=0\ \forall\ i,t.$$

Equation (1) is the market model and equation (2) is also the market model, but with several modifications. First, the abnormal return arising from the swap announcement is explicitly embedded within the returns generating process, and is given by $\tilde{\delta}_i'$. Second, $\tilde{\delta}_i'$ is allowed to vary cross-sectionally. Third, $\tilde{\delta}_i'$ is a stochastic linear function of J variables, $X_{j\in[1,J]}$. Without loss of generality, setting $X_{i1}=1\ \forall\ i$ accommodates an intercept term. Each $X_{j\neq 1}$ is a measure of the change in the market's expectation of the jth firm-specific attribute priced by the market. For example, traditional asset pricing theory identifies the priced attributes as the levels, timing, and riskiness of future cash flows. All $X_{j\neq 1}$ are scaled to the same percentage metric as $\tilde{A}_{iw}$ by deflating all dollar amounts by m_i, the market value of firm i's common stock on event day $\langle -1\rangle$. The term $\tilde{\eta}_i$ captures such miscellaneous influences as measurement error in the dependent variable, and/or omitted variables. The model is expressed in terms of two-day returns, because although it is assumed that the swap announcement was on either day ⟨0⟩ or ⟨+1⟩, it is not known for sure on which. As swaps were well spread out in calendar time, the assumption that $\text{cov}(\tilde{\epsilon}_{iw},\tilde{\epsilon}_{kw})=0\,\forall\, i\neq k$ is a reasonable one; the mean overlap between adjacent announcement windows in calendar time is one trading day. Last, setting $X_{i1}=1$ and $X_{ij}=0\,\forall\, j\geq 2$ yields an intercept equal to the unconditional mean abnormal announcement return.

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[25] The press-release usually revealed the upper bound on the number of shares which were to be involved in the equity side of the swap. However, the upper bound was reasonably close to the number of shares actually used to calculate the swap gain. Sixty percent of the swap gains were taken from *The Wall Street Journal* article reporting the swap (lying a median of 1 trading day after the SEC filing date for the common stock component), 22 percent came from the annual report for the year in which the swap was done, and 18 percent were calculated from information in the SEC filing. The accuracy of latter numbers was verified by using the same calculation method on the 82 percent from *The Wall Street Journal* or annual report and then compared the two sets of swap gains. Less one outlier, they were correlated 0.95 and their means lay within 1.2 percent of each other. Evidence that the market was able to form a rational estimate of the swap gain comes from the observation that my estimate of the mean abnormal common stock return on the swap completion date was 0.03 percent (t=0.2).

Define the "prediction error" over w by $\tilde{A}_{iw}$, where:

$$\tilde{A}_{iw}\equiv\tilde{R}_{iw}-\alpha_i-\beta_i\tilde{R}_{mw}. \tag{3}$$

Therefore, from equations (1), (2), and (3):

$$\tilde{A}_{iw}=\sum_{j=1}^{J}a_jX_{ij}+\tilde{\eta}_i+\tilde{\epsilon}_{iw}. \tag{4}$$

Since $\text{var}(\tilde{\epsilon}_{iw})$ is heteroscedastic over i, ordinary least squares (OLS) on equation (4) will not yield best linear unbiased estimators of the parameter set $\{a_1,\ldots a_J;\ \sigma_\eta^2\}$. The maximum likelihood (ML) method for simultaneously obtaining best linear unbiased estimators of $\{a_1,\ldots a_J;\ \sigma_\eta^2\}$ was thus applied. The ML method in effect weights each $\tilde{A}_{iw}$ and X_{ij} by a function of the total residual variance $(\sigma_\eta^2+\sigma_i^2)$, such that those prediction errors having a relatively larger residual variance σ_i^2 are weighted less. This is because for such observations the magnitude of the prediction error is more likely due to $\tilde{\epsilon}_{iw}$ than to $\tilde{\delta}_i$. Cross-sectional variance in the prediction errors that is left after accounting for that due to the $\Sigma_{j=1}^{J}\hat{a}_jX_{ij}$'s and the σ_i^2's is allocated to $\hat{\sigma}_\eta^2$.[26]

The parameters $\{\alpha_i,\beta_i,\sigma_i^2\}$ are assumed identical across equations (1) and (2). They were estimated by applying OLS to equation (1) on a firm-by-firm basis, using the 300 trading days ⟨+2, +301⟩; i.e., 150 × two-day periods.[27] An unbiased estimate of σ_i^2 was taken from the residual variance of the same regression. The realized common stock prediction error conditional on $\hat{\alpha}_i,\hat{\beta}_i$, and R_{mw} is then given by $A_{iw}=R_{iw}-\alpha_i-\beta_iR_{mw}$. The estimate of the variance of the residuals $\tilde{\epsilon}_{iw}$ is denoted by $\hat{\sigma}_{iw}^2$.[28] These estimates are substituted in place of the population values assumed by the ML procedure to obtain the ML estimates $\{\hat{a}_1,\ldots\hat{a}_J;\ \hat{\sigma}_\eta^2\}$. Stock price data came from the CRSP tapes.

Proxy for the Probability that the Firm's Motivation in Undertaking a Swap was to Smooth an Unexpected and Transitory Decrease in EPS

The proxy p_i for the true probability p_i^* that the firm's motivation in undertaking a swap was to smooth an unexpected and transitory decrease in EPS is based on the relative size of the swap gain. Let the size of the swap gain expressed as a percentage of the market value of the swapping firm's common stock as of one day prior to the swap announcement be denoted by SGAIN$_i$. Then, suppose that the larger is SGAIN$_i$, the larger is p_i^*. In other words, suppose that a swap that produced a very big/

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[26] Details of the procedure are available from the author on request.

[27] The choice of 300 days is arbitrary, but alternative numbers of days do not affect any empirical conclusions.

[28] $\hat{\sigma}_{iw}^2=\hat{\sigma}_i^2\left[1+\dfrac{1}{150}+\dfrac{(R_{mw}-\bar{R}_m)^2}{\Sigma_{t=(+2,+3)}^{(+300,+301)}(R_{mt}-\bar{R}_m)^2}\right]$; $\bar{R}_m=\dfrac{1}{150}\Sigma_{t=(+2,+3)}^{(+300,+301)}R_{mt}$, where the second and third terms in square brackets reflect the increase in error variance due to predicting A_{iw} outside the parameter estimation period. They stem from the sampling variances of the OLS estimates of α_i and β_i, respectively (see Patell [1976]).

small reported earnings gain was/was not very likely to have been undertaken for smoothing reasons.

The proxy p_i was arrived at via the following scaling procedure over $\log_e(\mathrm{SGAIN}_i)$. Let *minsz* and *maxsz* be the minimum and maximum values of $\log_e(\mathrm{SGAIN}_i)$ needed to satisfy

$$p_i = 1 - \frac{maxsz - \log_e(\mathrm{SGAIN}_i)}{maxsz - minsz} \qquad (5)$$

together with the constraints that

$$p_i[\mathrm{SGAIN}_i = minsz] = 0.10,$$
$$p_i[\mathrm{SGAIN}_i = maxsz] = 0.90. \qquad (6)$$

In words, p_i is scaled so that the maximum p_i for the swapping firms is 0.90 and the minimum p_i is 0.10. This scaling procedure yielded $minsz = -9.22$ and $maxsz = -1.38$. The rationale behind this procedure is threefold. First, the smoothing evidence seen thus far, in conjunction with the sinking-fund evidence to be reported in the next major section, suggest a wide range in the true p_i^*. Second, it seems reasonable to constrain $p_i \in (0, 1)$ and not allow the extremes $p_i = 0$ or $p_i = 1$. And third, the precursory use of the $\log_e(\bullet)$ transformation on SGAIN_i yielded a much less severely skewed distribution of p_i than without it. Since the scaling procedure was done *prior* to any empirical analysis, no bias is expected to be imparted it. The mean/median values of p_i were 0.48/0.50, respectively.

Since the p_i measures are proxies, they will contain measurement error relative to the true p_i^* that the market would have been using under the null hypothesis The measurement error arises from both the nature of the scaling process, and from the fact that, strictly speaking, the construction of p_i assumes that information on all the swap gains of the eventual population of swapping firms was available to the market just prior to each swap announcement. The impact of such measurement error on the regression coefficients is an empirical issue.

Coefficient Predictions

The predicted values on the regression coefficients under the smoothing hypothesis are as follows. If the swap gain is used at all to smooth an unexpected decrease in EPS (be it transitory or permanent), the coefficient a_2 on SGAIN_i will be negative. More precisely, if all firms are using the swap gain to smooth an unexpected and one-quarter transitory decrease in EPS, then $p_i = 1 \forall i$ and a_2 will equal -1. Alternatively, if some firms are using the swap gain to smooth an unexpected and one-quarter transitory decrease in EPS and some are not, and the true probability p_i^* assessed by the market at the swap announcement that firm i is smoothing is accurately captured by p_i, then the coefficient on $p_i \times \mathrm{SGAIN}_i$ will equal -1.

Cross-Sectional Regression Results

Table 7 reports the results of this cross-sectional regression method for the case where $X_{i2} = \mathrm{SGAIN}_i$, $X_{i3} = p_i \times \mathrm{SGAIN}_i$, and $X_{ij} = 0 \forall j \geq 4$. Since an initial analysis of the data revealed two outliers for X_{i2} and X_{i3}, results are reported both including and sequentially excluding these outliers. With respect to both SGAIN_i and $p_i \times \mathrm{SGAIN}_i$, all observations other than the two outliers were smoothly distributed below 4.12 standard deviations from the mean based on the full sample of 245 swaps.[29] The coefficient estimates change very little if observations over and above

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[29] In calculating these standard deviations, independent variables were first deflated by $(\hat{\sigma}_{\eta}^2 + \hat{\sigma}_{iw}^2)^{0.5}$, as it is the deflated values that the ML regression procedure effectively uses in estimating the regression coefficients.

TABLE 7

CROSS-SECTIONAL REGRESSIONS OF THE TWO-DAY SWAP ANNOUNCEMENT STOCK PREDICTION ERRORS (A_{iw}) ON THE SWAP REPORTED EARNINGS GAINS (SGAIN$_i$), AND SGAIN$_i$ × A PROXY FOR THE PROBABILITY THAT THE MARKET ASSESSED THE FIRM'S MOTIVATION IN UNDERTAKING A SWAP TO BE TO SMOOTH AN UNEXPECTED AND ONE-QUARTER FALL IN EPS (p_i × SGAIN$_i$)

(1981-1984)

(n=245)

MAXIMUM LIKELIHOOD on:

$$\tilde{A}_{iw}=a_1+a_2\text{SGAIN}_i+a_3p_i\times\text{SGAIN}_i+\tilde{\eta}_i+\tilde{\epsilon}_{iw}\,^2$$

$\hat{a}_1$	$\hat{a}_2$	$\hat{a}_3$	$\hat{\sigma}^2_\eta$	K—S^3	$\bar{R}^2$	*Number of Outliers Trimmed*	*Number of Standard Deviations of Outliers from the Sample Mean*
−0.013 (−7.9)[1]			0.000156 (2.7)	0.59 (0.88)	—	0	—
−0.011 (−5.1)	−0.35 (−1.72)		0.000149 (2.6)	0.72 (0.68)	0.013	0	—
−0.010 (−4.4)	−0.52 (−2.24)		0.000149 (2.6)	0.67 (0.76)	0.016	1	6.9
−0.009 (−4.0)	−0.68 (−2.80)		0.000141 (2.5)	0.68 (0.74)	0.028	2	6.9 5.2
−0.011 (−5.8)		−0.44 (−1.64)	0.000149 (2.6)	0.68 (0.74)	0.013	0	—
−0.010 (−5.1)		−0.74 (−2.35)	0.000148 (2.6)	0.65 (0.79)	0.018	1	8.3
−0.009 (−4.6)		−1.02 (−3.00)	0.000139 (2.5)	0.68 (0.74)	0.035	2	8.3 5.4

[1] t-statistics with respect to a null value of zero are in (.), except for the K—S Z-statistic, where it denotes the two-tailed p-value.

[2] Null is that $\tilde{\eta}_i\sim iid\text{N}(0,\sigma^2_\eta)$; $\tilde{\epsilon}_{iw}\sim indep\text{N}(0,\sigma^2_i)$; $\text{cov}(\tilde{\eta}_i,\tilde{\epsilon}_{kw})=0\ \forall\ i,k$.

[3] Kolmogorov-Smirnov Z-statistic that the fitted residuals deflated by $\hat{\Gamma}_i=(\hat{\sigma}^2_\eta+\hat{\sigma}^2_{iw})^{0.5}$ are $\sim iid\text{N}(0,1)$.

those labelled as outliers are excluded from the regressions. Inferences below are based on the regressions where both outliers have been excluded.

From Table 7 note the following. First, the Kolmogorov-Smirnov one sample goodness-of-fit Z-statistics and associated p-values suggest that the regressions are reasonably well-specified. Second, the coefficient estimate $\hat{a}_2$ is −0.68 with t-statistics with respect to null values of zero and −1 of −2.80 and 1.29, respectively. Third, the coefficient estimate $\hat{a}_3$ is −1.02 with t-statistics with respect to null values of zero and −1 of −3.00 and −0.05, respectively. While the value of $\hat{a}_2$ is consistent with the hypothesis that the market repriced each swapping firm's stock on the basis that with probability one each firm was swapping to smooth its earnings, the data appear to be *more* consistent with the probabilistic version of the smoothing hypothesis.[30]

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[30] Similar results were obtained from simple ordinary least squares regression: $\hat{a}_2$= −0.67, t-statistics with re-

Fourth, the smoothing hypothesis is unable to completely explain either the magnitude of the mean abnormal return or the cross-sectional variation in individual abnormal returns. The coefficient estimate $\hat{a}_1$ is always negative with a t-statistic larger than -4.0, and the t-statistics on the estimates of σ_η^2 imply that there is reliable cross-sectional variation in the individual two-day stock prediction errors over and above that due to normal factors (captured by $\hat{\sigma}_{iw}^2$) and the independent variables SGAIN_i or $p_i \times \text{SGAIN}_i$.

Finally, one particular set of robustness tests were applied. These were designed to address a potential criticism of the results obtained using $p_i \times \text{SGAIN}_i$. This criticism is that an alternative explanation for the observed value of $\hat{a}_3$ is that SGAIN_i has merely been multiplied by 0.5 + mean zero noise (the noise criticism). In other words, the criticism is that either the true probability $p_i^* = 1 \forall i$ and the proxy p_i used is merely noise scaled to lie between zero and one, or that $p_i^* \in (0, 1)$ and varies cross-sectionally, but the p_i used are uncorrelated with the true p_i^*'s because they are noise scaled to lie between zero and one. If the p_i's are only noise with mean 0.5, then the estimated coefficient on $p_i \times \text{SGAIN}_i$ can be greater than that on SGAIN_i.

This prediction was tested in the following manner. One hundred samples of 245 observations each were generated from a Normal distribution with mean 0.5 and variance 0.0213. This distribution closely approximates the actual p_i distribution. The regression reported in the seventh line-pair of Table 7 was then rerun 100 times using the white noise data instead of the actual p_i's. Following Table 7, observations from the pseudo $p_i \times \text{SGAIN}_i$ distribution that lay more than 4.12 standard deviations from their mean were deleted. The mean value of the resulting estimates of a_3 was -1.16, which is further from the predicted value of -1.00 than is $\hat{a}_3 = -1.02$ from Table 7. This is inconsistent with the noise criticism. Also, only one out of the 100 regressions using the pseudo $p_i \times \text{SGAIN}_i$ data yielded an adjusted R^2-statistic that was greater than the 0.035 reported in Table 7. Last, the mean and median standard error of the coefficient $\hat{a}_3$ in the 100 regressions were both 0.48 compared to 0.34 for the standard error of $\hat{a}_3$ reported in Table 7. These results are contrary to the noise criticism, as the noise criticism jointly predicts that the mean adjusted R^2-statistic and the mean standard error on $\hat{a}_3$ from the 100 regressions will equal those found in Table 7.

The Sinking-Fund Hypothesis

This section describes and tests a second hypothesis for why firms undertook debt-equity swaps. The hypothesis is that swaps enabled firms to relax potentially binding sinking-fund constraints in the cheapest feasible manner. I conclude that the data is only weakly consistent with the sinking-fund hypothesis.

The sinking-fund motivation was sometimes alluded to in the financial press.

> A less evident but no less valid reason many finance professionals think swaps make sense is that they help many companies meet sinking-fund obligations in advance [McGoldrick, 1982, p. 197].

The majority of corporate debt issued over the past 50 years has contained sinking-fund provisions [Thompson and Norgaard, 1967; McKeon, 1980]. A sinking-fund is a promise to repay the princi-

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spect to zero and -1 being -2.76 and 0.74, respectively; and $\hat{a}_3 = -0.97$, with t-statistics with respect to zero and -1 being -2.93 and 0.09, respectively.

pal in installments, typically annually over the last ten to 20 years to maturity. Each year the sinking-fund is effective the firm must satisfy the sinking-fund requirement contracted in the bond covenant by either repurchasing the required amount in the open market and then delivering it to the bond trustee, or by providing the bond trustee with enough cash to call the required amount of bonds by lottery. The levels of sinking-fund repayments are usually constant across time but can also vary from year to year, often increasing towards maturity. A firm can almost always prepurchase and hold as inventory as many years worth of sinking-fund repayments as it wishes, thereby moving it further away from its sinking-fund constraint.[31]

As noted in Section I, when the Bankruptcy Tax Act of 1980 came into effect on January 1, 1981, for several reasons it imposed significant expected costs on firms that held sinking-fund debt [Forbes, 1981a]. First, at that time most debt (whether sinking-fund or not) was selling at a substantial discount to par. Second, prior to the invention of the debt-equity swap, retiring debt selling at a discount to par meant that the (positive) difference between par and the price paid for the debt was taxable. As a result, the attractiveness of issuing new sinking-fund debt fell, and the required open market repurchases needed in order to meet sinking-fund payments on existing debt became more costly than before. And third, interest rates were expected to remain high for several years.

The development of the debt-equity swap in mid-1981 meant that this tax penalty could be avoided. However, the opportunity swaps afforded was not expected to last for long; it was uncertain whether the Internal Revenue Service would permit the swap "loophole" to survive [Meyer and Jetmore, 1982; McGoldrick, 1982; and Institutional Investor, 1982]. As a result, several predictions follow. First, less debt issued after January 1981 should have had a sinking-fund provision than that issued prior to January 1981. Second, the percentage of bonds swapped that had a sinking-fund should have been greater than the corresponding percentage for bonds of the swapping firms that were not swapped, and also greater than the corresponding percentage for bonds of a random sample of firms that did no swaps.

Third, bonds that were swapped should have been closer to their sinking-fund constraints and/or lower in price than both bonds of the swapping firms that were not swapped, and bonds of a random sample of firms that did no swaps. This prediction follows because under the sinking-fund hypothesis, bonds that were swapped should have been those that were closest to their mandatory sinking-fund constraints, and/or selling at the largest discount to par, since theirs was the greatest present value of expected future tax costs in the absence of a swap. And fourth, the average expected future marginal tax rate of a swapping firm should be higher the closer was the firm to its sinking-fund constraints, since the higher the average expected future marginal tax rate, the greater was the present value of expected future tax costs in the absence of a swap.

Empirical Tests on the Sinking-Fund Predictions

The prices of bonds swapped and not swapped have already been examined in Table 7, where the evidence is consistent

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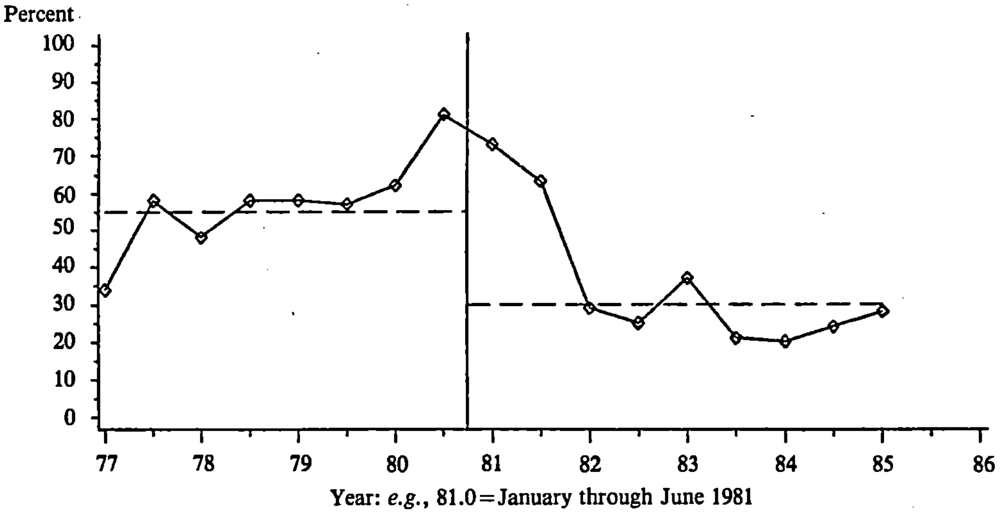
[31] By prepurchasing the firm may be able to avoid being cornered by sinking-fund hoarders, although Leader [1977] reports that "buying two years in advance seems to be about the outer limit in the minds of most sinking-fund men. Beyond that, prepurchasing verges on being an investment . . ." [p. 96].

FIGURE 5

TIME-SERIES PLOT OF THE PERCENTAGE OF DEBT ISSUED PRE- AND POST-JANUARY 1981 WHICH CONTAINED SINKING-FUND PROVISIONS



Notes: The horizontal dotted lines are pre- and post-January 1981 means.

The vertical bar splits the pre- and post-January 1981 periods.

Data comes from the Registered Offerings of Securities tape.

Total number of bonds tabulated in pre- and post-January 1981 are 1,491 and 2,960, respectively.

with the selling price aspect of the third prediction. Therefore, focus of the empirical analysis in this subsection is on the remaining aspects of the four predictions.

Figure 5 presents a time-series plot of the percentage of debt issued with a sinkking-fund provision pre- and post-January 1981. The data came from the Registered Offerings of Securities tape and spans the period January 1977 through June 1985. Each point covers a six-month interval (January–June or July–December). The evidence from Figure 5 is broadly consistent with the proposition that the Tax Act imposed additional costs on sinking-fund debt; the mean percentages of debt issued pre- versus post-January 1981 with a sinking-fund provision are 55 percent and 30 percent, respectively ($t=12.9$; $n_{\text{pre-810101}}=1491$, $n_{\text{post-810101}}=2960$).[32] However, it appears that firms responded to the Tax Act with a one year lag, perhaps for "sticky" institutional reasons.[33]

Next, Table 8 describes the three groups of bonds. Of bonds that were swapped, 85 percent had a sinking-fund provision, whereas only 37 percent of bonds of the swapping firms that were not swapped were in this category. The

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[32] As a cross-check on these results, also tabulated were the percentage of bonds issued pre- and post-January 1981 that had sinking-fund provisions using bonds that were swapped, bonds of the swapping firms that were not swapped, and bonds of the random sample of firms that did no swaps. The results averaged across all these bonds are 74 percent and 33 percent, respectively ($t=11.7$; $n_{\text{pre-810101}}=1447$, $n_{\text{post-810101}}=200$).

[33] It may also be the case that the total amount of sinking-fund debt issued would have been a function of the level of interest rates absent the Tax Act. However, this is difficult to determine with accuracy.

TABLE 8

COMPARISON OF THE CHARACTERISTICS OF BONDS THAT WERE SWAPPED WITH THOSE OF BONDS (1) OF THE SWAPPING FIRMS THAT WERE NOT SWAPPED, AND (2) A RANDOM SAMPLE OF 245 FIRMS THAT DID NO SWAPS[1]

(1981–1984)

Statistic	*Bonds Swapped*	*Bonds Not Swapped*	*Bonds of a Random Sample of 245 Firms that did No Swaps*
Percent of bonds which had sinking-funds (all debt included)	85	37	40
Percent of bonds which had sinking-funds (serial debt excluded)	91	49	61
Bond Type	*Percent of Obs.*	*Percent of Obs.*	*Percent of Obs.*
Sinking-Fund Debentures	80	27	15
Sinking-Fund Convertible	3	4	5
Notes (of any type)	11	42	35
First Mortgage	2	4	27
Industrial Revenue	1	1	4
Debentures	1	7	5
Equity Trust	0	7	3
Other	2	8	6
Total Number of Bonds	449	1,284	809

[1] Each observation is an individual bond, not an equally-weighted portfolio as in some previous Tables.

corresponding figure for bonds of the random sample of firms that did no swaps is 40 percent. These figures are slightly misleading in that public utilities are included in each group. Public utilities issue large numbers of bonds, most of which are serial in nature. The percentages were recalculated excluding serial debt (as an approximation for examining industrial debt only) and the figures for the three groups are then 91 percent, 49 percent, and 61 percent, respectively. These numbers are consistent with the sinking-fund hypothesis.

To test whether sinking-fund bonds that were swapped lay closer to their constraints than both bonds of the swapping firms that were not swapped, and bonds of the random sample of firms that did no swaps, three measures of closeness were used. The first two have been referred to in the financial press and the third is their sum. Three are employed in order to evaluate the robustness of any inferences made. The first measure is the number of years' worth of sinking-fund repayments already held in stock prior to the swap announcement. It is often alluded to in the financial press [Leader, 1977].[34] The second is the

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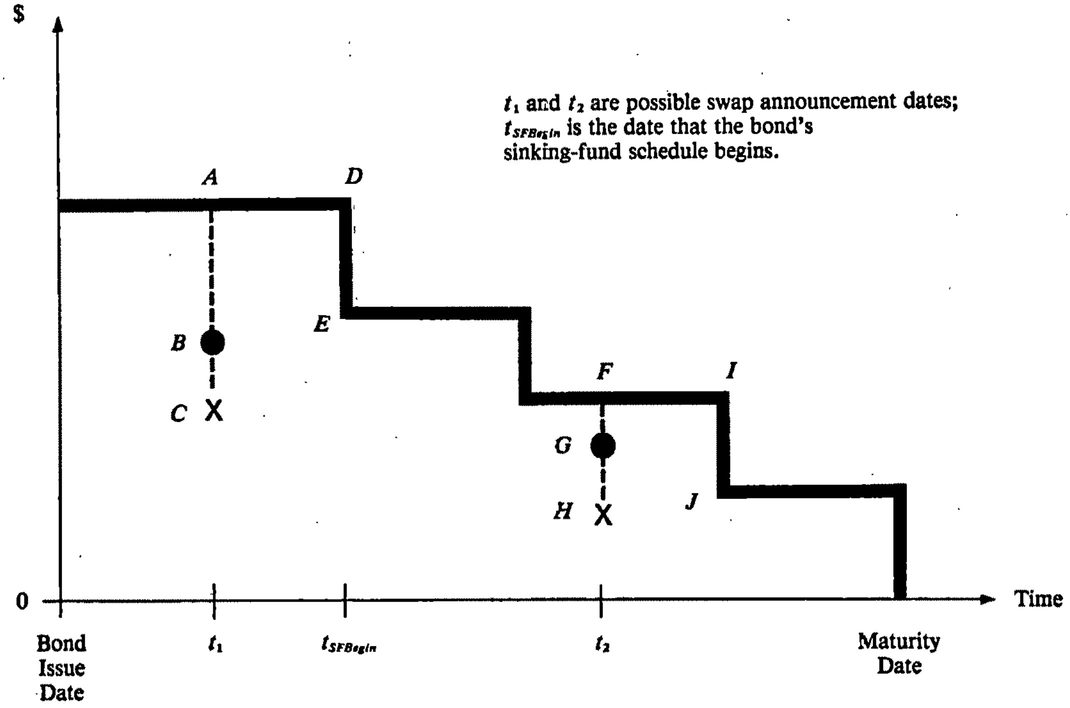
[34] The number of years worth of sinking-fund repayments in stock is defined as {the amount of debt originally issued – the amount of debt that the sinking-fund required to have already been met (as of the swap announcement) – the amount of the debt outstanding at the end of the fiscal year prior to the swap announcement} ÷ the amount of the next sinking-fund repayment. For those swaps which were not the first swap done in a particular fiscal year, the amount of debt outstanding at the end of the fiscal year prior to the swap announcement is reduced by the sum of the amounts retired by previous swaps in that fiscal year.

FIGURE 6

A GRAPHICAL EXPLANATION OF THE MEASURES DESCRIBING THE CLOSENESS OF A BOND TO ITS SINKING-FUND CONSTRAINTS



t_1 and t_2 are possible swap announcement dates; $t_{SFBegin}$ is the date that the bond's sinking-fund schedule begins.

Definitions: ▬ = Maximum amount of bond issue that can be outstanding at any time.
● = Amount outstanding prior to swap.
X = Amount outstanding after swap.

	At t_1	*At t_2*
1. Amount of next scheduled sinking-fund	*DE*	*IJ*
2. Number of years' worth of sinking-fund repayments already in stock prior to swap	$\frac{AB}{DE}$	$\frac{FG}{IJ}$
3. Number of years between swap announcement and next scheduled sinking-fund repayment	*AD*	*FI*
4. Sum of 2. and 3. (note that $0 \leq FI < 1$ year, but $AD \geq 0$)	$\frac{AB}{DE}+AD$	$\frac{FG}{IJ}+FI$
5. Amount purchased in swap.	*BC*	*GH*

number of years between the swap announcement and the date of the next scheduled (not effective) sinking-fund repayment. This measure is a relevant alternative to the first because if the swap announcement occurs prior to the date on which the sinking-fund formally begins, the firm has more time to fulfill

TABLE 9

COMPARISON OF {THE NUMBER OF YEARS OF UPCOMING SINKING-FUND REPAYMENTS ALREADY HELD IN STOCK PRIOR TO THE SWAP ANNOUNCEMENT + THE NUMBER OF YEARS BETWEEN THE SWAP ANNOUNCEMENT AND THE DATE OF THE NEXT SCHEDULED SINKING-FUND REPAYMENT} FOR BONDS THAT WERE SWAPPED AND BONDS (1) OF THE SWAPPING FIRMS THAT WERE NOT SWAPPED, AND (2) OF A RANDOM SAMPLE OF 245 FIRMS THAT DID NO SWAPS (1981–1984)

Statistic	*Bonds Swapped*	*Bonds Not Swapped*	*Bonds of a Random Sample of 245 Firms that did No Swaps*
Mean	5.3	6.5	4.6
Median	4.7	5.8	3.7
Quartiles: Upper/Lower	7.0/3.2	8.5/3.8	6.7/2.0
Standard Deviation	3.2	4.3	3.2
Min./Max.	0.3/24.8	0.8/31.3	0.4/15.5
Number of Obs.[1]	203	159	88

t-tests for Differences in Means

1. Paired-sample t-statistic between the means of bonds that were swapped, and bonds of the swapping firms that were not swapped $= -3.6$ (62 percent of individual differences <0, $n=141$).
2. Independent samples t-statistic between the means of bonds of the swapping firms that were not swapped, and bonds of a random sample of 245 firms that did no swaps $=3.7$.
3. Independent samples t-statistic between the means of bonds that were swapped, and bonds of a random sample of firms that did no swaps $=1.9$.

[1] Each observation is an equally-weighted mean across the bonds in that category for the participating firm.

the next effective upcoming sinking-fund requirement than if it is past this date. The third is the sum of these two measures. Years are used as the metric as it standardizes across different firm sizes. The first two measures are correlated -0.17 ($t=-2.4$, $n=198$) so they are neither mutually exclusive nor perfectly correlated. Figure 6 visually illustrates the differences between the three measures.

Table 9 reports the results using the third and broadest measure of the closeness of a firm to its sinking-fund constraints. The mean (number of years of upcoming sinking-fund repayments already held in stock prior to the swap announcement + the number of years between the swap announcement and the date of the next scheduled sinking-fund repayment) are 5.3 years for bonds that were swapped, 6.5 years for bonds of the swapping firms that were not swapped, and 4.6 years for bonds of the random sample of firms that did no swaps. The paired-sample t-statistic between the means of 5.3 and 6.5 years is $t=-3.6$ (62 percent of individual differences <0, $n=141$). This is consistent with the sinking-fund hypothesis. However, the mean of 5.3 for bonds that were swapped is higher of the mean of 4.6 for bonds of the random sample of firms that did no swaps ($t=1.9$); this is inconsistent with the sinking-fund hypothesis.

Tables 10 and 11 present statistics on the first and second measures of closeness. These tables allow determination

TABLE 10

COMPARISON OF THE NUMBER OF YEARS OF UPCOMING SINKING-FUND REPAYMENTS ALREADY HELD IN STOCK PRIOR TO THE SWAP ANNOUNCEMENT FOR BONDS THAT WERE SWAPPED AND BONDS (1) OF THE SWAPPING FIRMS THAT WERE NOT SWAPPED, AND (2) OF A RANDOM SAMPLE OF 245 FIRMS THAT DID NO SWAPS (1981–1984)

Statistic	*Bonds Swapped*	*Bonds Not Swapped*	*Bonds of a Random Sample of 245 Firms that did No Swaps*
Mean	2.6	2.9	1.7
Median	2.0	1.5	0.8
Upper Quartile	4.0	3.6	2.1
Lower Quartile	0.3	0.1	0.0
Min./Max.	0.0/19.7	0.0/30.0	0.0/14.6
Standard Deviation	2.9	4.3	2.7
Number of obs.[1]	199	157	83
Percent of obs. = 0	22%	19%	23%

t-tests for Differences in Mean Number of Years in Stock

1. Paired-sample t-statistic between the mean number of years stock of bonds that were swapped, and bonds of the swapping firms that were not swapped $= -0.8$ (45 percent of differences <0, $n=137$).
2. Independent samples t-statistic between the mean number of years stock of bonds of the swapping firms that were not swapped, and the bonds of a random sample of firms that did no swaps $=2.3$.
3. Independent samples t-statistic between the mean number of years stock of bonds that were swapped, and bonds of a random sample of firms that did no swaps $=2.4$.

Statistics on the Number of Years of Upcoming Sinking-Fund Repayments Purchased in the Swaps

Mean	*Median*	*Min.*	*Max.*	*Quartiles*	*Std. Dev.*	n
3.8	3.2	0.3	14.7	4.9/1.9	2.6	201

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[1] Each observation is an equally-weighted mean across the bonds in that category for the participating firm.

of whether the inferences from Table 9 are driven by the first or the second measures, or both. Table 10 presents statistics on the number of years' worth of sinking-fund repayments in stock and the number of years' worth of sinking-fund repayments purchased in the swaps. The mean for the latter variable is 3.8 years. As of the swap announcement, the mean number of years' worth of sinking-fund repayments already in stock are 2.6 for bonds that were swapped, 2.9 for bonds of the swapping firms that were not swapped, and 1.7 for bonds of the random sample of firms that did no swaps. The paired-sample t-statistic between the means of 2.6 and 2.9 is $t=-0.8$ (50 percent of individual differences ≤ 0, $n=137$). The independent-samples t-statistic between the means of 2.6 and 1.7 is $t=2.4$. Both t-statistics are inconsistent with the sinking-fund hypothesis; they suggest that bonds that were swapped were no closer to their sinking-fund constraints than bonds that were not swapped.

TABLE 11

COMPARISON OF THE NUMBER OF YEARS BETWEEN THE SWAP ANNOUNCEMENT AND THE DATE OF THE NEXT SINKING-FUND REPAYMENT OF BONDS THAT WERE SWAPPED AND BONDS (1) OF THE SWAPPING FIRMS THAT WERE NOT SWAPPED, AND (2) OF A RANDOM SAMPLE OF 245 FIRMS THAT DID NO SWAPS (1981–1984)

Statistic (Number of Years)	*Bonds Swapped*	*Bonds Not Swapped*	*Bonds of a Random Sample of 245 Firms that did No Swaps*
Mean	2.8	3.6	3.0
Median	1.9	3.0	1.8
Standard Deviation	2.0	2.6	2.6
Quartiles: Upper/Lower	3.8/1.4	5.0/1.5	4.4/1.3
Min./Max.	0.3/12.7	0.1/10.6	0.1/9.7
Number of obs.[1]	202	163	94

t-tests for Differences in Mean Number of Years

1. Paired-sample t-statistic between the mean number of years to the next sinking-fund repayment date of bonds that were swapped, and bonds of the swapping firms that were not swapped $= -4.2$ (63 percent of differences <0, $n = 143$).
2. Independent samples t-statistic between the mean number of years to the next sinking-fund repayment date of bonds of the swapping firms that were not swapped, and bonds of a random sample of firms that did no swaps $= 1.7$.
3. Independent samples t-statistic between the mean number of years to the next sinking-fund repayment date of bonds that were swapped, and bonds of a random sample of firms that did no swaps $= -1.0$.

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[1] Each observation is an equally-weighted mean across the bonds in that category for the participating firm.

Table 11 reports statistics on the number of years between the swap announcement and the date of the next scheduled sinking-fund repayment. The mean number of years are 2.8 for bonds that were swapped, 3.6 for bonds of the swapping firms that were not swapped, and 3.0 for the bonds of the random sample of firms that did no swaps. The paired-sample t-statistic between the means of 2.8 and 3.6 is $t = -4.2$ (63 percent of individual differences <0). This is consistent with the sinking-fund hypothesis. It is this measure of the closeness of a firm to its sinking-fund constraints that drives the inference in Table 9 that the data accords with the predictions from the sinking-fund hypothesis.

Last, the prediction that the average expected future marginal tax rate of a swapping firm should be higher the closer was the firm to its sinking-fund constraints was tested in the following way. From the *Value Line* publication that lay closest to prior to the swap announcement, I collected *Value Line*'s (book) estimate of the "income tax rate" for the fiscal year following that in which the swap announcement lay, denoted τ_i^m. The median/mean values of τ_i^m were 39 percent/37 percent, respectively, with a standard deviation of 9.5 percent. τ_i^m is taken to be a fair proxy for the true average expected future marginal tax rate of firm i.

Let the measures of closeness used

earlier, namely (a) the number of years' worth of sinking-fund repayments already held in stock prior to the swap, (b) the number of years between the swap announcement and the date of the next scheduled (not effective) sinking-fund repayment, and (c) their sum, be denoted by YRSTK$_i$, YRTONSF$_i$, and SUMSTK$_i$, respectively. The product-moment correlations (with two-tailed p-values in parentheses) between τ_i^m and YRSTK$_i$, YRTONSF$_i$, and SUMSTK$_i$ are −0.12 (0.05), 0.02 (0.45), and −0.10 (0.07). The rank-order correlations are very similar. While these results are consistent with the sinking-fund hypothesis if YRSTK$_i$ or SUMSTK$_i$ is the true measure of how close a firm was to its sinking-fund constraints, they are inconsistent if YRTONSF$_i$ and not YRSTK$_i$ is the true measure. Since in Table 11 it appeared that YRTONSF$_i$ was the measure of closeness that yielded results consistent with the sinking-fund hypothesis, these correlation results and the mean comparison results in Table 11 seem contradictory.

Considering overall the empirical results on the four testable predictions arising from the sinking-fund hypothesis, I infer that the data is only weakly consistent with it.

Comparison of the Smoothing and Sinking-Fund Hypothesis

Having examined some testable implications generated by both the smoothing and the sinking-fund hypotheses, this subsection poses and attempts to answer two questions that naturally arise out of the analysis. First, are the smoothing and sinking-fund hypotheses exhaustive with respect to explaining why firms undertook debt-equity swaps? And second, are the managerial motivations underlying the two hypotheses substitutes, complements, or independent of one another?

The two hypotheses that this paper has focused on are not the only ones that are plausible. For example, Hand [1987] examined some of the testable implications of three others. Briefly, these were that (1) swaps were disguised equity issues [McGoldrick, 1982; Sloan and Spragins, 1981b]; (2) swaps were undertaken as part of a debt-refunding operation [Rogers and Owers, 1985; Finnerty, 1985; and Bierman, 1986]; and (3) swaps were undertaken in order to increase management's compensation [Defeo et al., 1986].[35] However, none of these hypotheses yielded results that were as consistent with the data as were those from the smoothing and sinking-fund hypotheses.

With respect to whether two hypotheses were substitutes, complements, or independent of one another, each hypothesis' tests were conducted under the implicit assumption that they were independent. To ascertain whether this was a reasonable assumption, the correlations were calculated between p_i and YRSTK$_i$, YRTONSF$_i$, SUMSTK$_i$, and τ_i^m. If the smoothing and sinking-fund motivations were substitutes (i.e., firms that with a high probability swapped for smoothing reasons were also firms that were far away from their sinking-fund constraints and, therefore, unlikely to have swapped for sinking-fund reasons), then the correlations between p_i and YRSTK$_i$, YRTONSF$_i$, and SUMSTK$_i$ should be positive; if complements then negative and if independent of one another then zero. The product-moment correlations (with two-tailed p-values in parentheses) are -0.24 (<0.01), 0.04 (0.27), and -0.19 (<0.01); this is consistent with the two motivations being complements. The rank-order correlations are very similar. However, based on such complementarity, one can also predict that firms that swapped for smoothing reasons (firms where p_t was high) should then have been firms for which the present value of expected future tax costs of not using swaps to meet upcoming sinking-fund repayments was high (firms where τ_t^m was high). However, the product-moment and rank correlations between p_t and τ_t^m are -0.17 (<0.01) and -0.12 (0.03), respectively, which is consistent with the motivations behind swapping for smoothing and sinking-fund reasons being substitutes, not complements.

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[35] The first two were noted and tested subsequent to the development and testing of the smoothing and sinking-fund hypotheses, and the third was already under investigation by its authors by the time my own work began.

I, therefore, conclude that although the smoothing and sinking-fund hypotheses considered together probably explain much more than several other possible hypotheses not examined in this paper, it is not clear whether they (and the managerial motivations underlying them) were complements, substitutes, or independent of one another.

IV. SUMMARY AND CONCLUSIONS

This paper has examined in detail the testable implications of two hypotheses for why firms undertook debt-equity swaps. The first hypothesis was that firms used the swap gain to smooth an unexpected and transitory decrease in their year-to-year quarterly EPS. The second hypothesis was that swaps enabled firms to relax potentially binding sinking-fund constraints in the cheapest feasible manner. Both hypotheses yielded testable implications spanning a variety of observable variables. After empirical tests, I conclude that firms undertook debt-equity swaps for both reasons, but that swapping to smooth earnings was a much stronger motivation than swapping to relax potentially binding sinking-fund constraints.

However, puzzles remain. For example, neither the swap gain nor the probability proxy × the swap gain were able to fully explain either the magnitude of the mean abnormal return at the swap announcement date or the amount of cross-sectional variation in individual abnormal returns. This implies that the swap announcement conveyed bad news over and above that captured by these variables. However, no other candidate hypotheses appear to be able to provide additional explanatory power that is of the same order of magnitude as the swap gain. For example, Scholes and Wolfson's [1987] general explanation for the empirical regularity between leverage decreasing events and associated negative mean abnormal announcement returns implies most reasonably in the case of swaps that the decrease in expected future cash flows be other than a purely transitory one. The evidence in Figures 2 and 3 is inconsistent with such an explanation. Neither are the level of any premiums paid by the investment banker for the bonds, or benefits from bond covenant relaxation hopeful avenues. Informal evidence suggests that bond premiums were of an order of magnitude smaller than the swap gain, and swaps very rarely retired an entire bond issue.

The analysis, therefore, closes with a speculation: although firms' managers prefer smoothed EPS, the capital market does not—it sees smoothing at best as an additional layer of noise to be filtered out in arriving at the attributes it values, and at worst as a deliberate falsification of the firm's true performance. If so, and if the market normally has imperfect information on which firms can/cannot and do/do not smooth their EPS, then perhaps by undertaking a swap, the swapping firm blatantly revealed its nature as a "smoother." As a result, the market reassessed its past and expected future earnings and extracted a penalty reflecting its increased distrust of management's commitment to maximizing the value of the firm.

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The Nature and Amount of Information in Cash Flows and Accruals

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ABSTRACT: Based on stock price behavior around the release of annual reports in 1981 and 1982, Wilson [1987] concludes that for a given amount of earnings, the market reacts more favorably the larger (smaller) are cash flows (current accruals). The goals of this paper are to assess the generality of Wilson's finding and to assess alternative economic arguments that would manifest themselves as a "preference" for cash flows over current accruals. For the overall period, 1977-1984, there is no evidence of the simple relation observed by Wilson in his two-quarter test period. We then examine progressively more contextual models of the implications of cash flows and accruals. These models are also unsuccessful in explaining stock price behavior around the release of detailed financial statements. We conclude that either (1) the security price reactions to the release of cash flow and accrual data in financial statements are too highly contextual to be modeled parsimoniously, or (2) important uncertainties about the contents of detailed financial statements are resolved prior to their public release.

BASED on a sample of observations from the fourth quarters of fiscal years 1981 and 1982, Wilson [1987, table 1] finds evidence that for a given amount of earnings, the stock market reacts more favorably the larger (smaller) is the cash flow (accrual) component. Wilson's tests are based on stock price behavior during the nine days surrounding the release of the annual report, when detailed earnings information (including cash flows and accruals) is publicly disclosed for the first time.

This paper extends the work of Wilson in two ways. The first is to assess the generality and robustness of Wilson's result by conducting the same tests over 32 quarters using a largely independent sample of firms. The results do not contradict Wilson's for the two quarters that he examined, but there is no evidence of a similar result for the overall period, 1977-1984.

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Given the failure to confirm the simple relation observed by Wilson, the second step is to examine progressively more contextual models of the implications of cash flows and accruals. We argue that it is not obvious that cash flows should be "preferred" to accruals on average. However, motivated by Wilson [1987, p. 320], we hypothesize that such a "preference" might arise under certain macroeconomic conditions. No support for that hypothesis is found. An alternative hypothesis under which the nature of information conveyed by cash flow and accrual data varies according to which specific accrual accounts are unexpectedly high or low is offered but, again, we fail to find support for the hypothesis.

In sum, we are unable to identify the economic logic underlying how the market assimilates information about cash flows and accruals. That is, we find no systematic difference between the implications of cash flows and accruals, as reflected in stock price behavior surrounding the release of detailed financial statements.

There are at least two possible interpretations of the evidence. One is that the differential price implications of the cash flow and accrual components of earnings are so highly contextual that they are not amenable to parsimonious modeling. An alternative interpretation is that it is inherently difficult to detect reactions to the release of detailed financial statements, in part because any important uncertainties about their contents may have been resolved prior to their publication. Note that although the latter explanation is inconsistent with the results of Wilson [1987], it may warrant attention, given how brief was the time period he examined, and how modest was the explanatory power of his model (R^2 less than .03; see Wilson [1987, table 1]). Moreover, others have been unable to detect unusual variance in stock prices around the release of detailed financial statements.[1]

The rest of the paper is organized as follows. Section I discusses prior research and outlines reasons why the valuation implications of cash flows and accruals might differ. Section II describes the present data and Section III applies the tests of Wilson [1987] to the data. In Sections IV through VI, we test more contextual models of the security price implications of cash flows and accruals. Conclusions are offered in Section VII.

I. THE POTENTIAL INFORMATION IN CASH FLOWS AND ACCRUALS

Existing Evidence

Prior studies of the information in cash flows and accruals [Wilson, 1986 and 1987; Rayburn, 1986; and Bowen et al., 1987] can be interpreted within a common framework. Each decomposed accounting earnings as follows:

Cash Flow from Operations
+Current Accruals

=Working Capital from Operations
+Noncurrent Accruals

=Accounting Earnings.

Here, current accruals include such items as increases in inventories and receivables and decreases in payables, while depreciation and deferred income taxes are (negative) noncurrent accruals.

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[1] Foster et al. [1986] find no unusual price volatility in the week of annual report releases (the annual report may or may not have been preceded by a 10-K release, as in Wilson [1987]). Foster et al. [1983] find no evidence of higher-than-average price volatility in the week of a 10-K release, given that the annual report has already been released (this represents a reversal of the conclusion in Foster and Vickrey [1978]). To our knowledge, there is currently no evidence on the price volatility surrounding the release of the *earlier* of the 10-K or the annual report.

Each of the studies involves regressions of stock return metrics against the unexpected portions of the above components of earnings (or combinations thereof). Writing the abnormal return on security j in period t (R_{jt}) as a function of unexpected operating cash flows (UCF_{jt}), unexpected current accruals (UCA_{jt}), unexpected noncurrent accruals ($UNCA_{jt}$), and a disturbance term, u_{jt} yields:

$$R_{jt}=b_0+b_1(UCF_{jt})+b_2(UCA_{jt}) +b_3(UNCA_{jt})+u_{jt}. \tag{1}$$

An alternative representation of the same equation denotes unexpected working capital from operations as $UWCO_{jt}$(thus $UWCO_{jt}=UCF_{jt}+UCA_{jt}$), and unexpected accounting earnings as UE_{jt}(thus $UE_{jt}=UWCO_{jt}+UNCA_{jt}$). Substituting ($UWCO_{jt}-UCF_{jt}$) for UCA_{jt} and ($UE_{jt}-UWCO_{jt}$) for $UNCA_{jt}$, in equation (1), yields:

$$R_{jt}=b_0+(b_1-b_2)UCF_{jt} +(b_2-b_3)UWCO_{jt} +b_3UE_{jt}+u_{jt}. \tag{2}$$

In Wilson [1987], the event window is centered around the publication of the annual report, at which time earnings have already been announced. Therefore, in that design, unexpected earnings must be zero ($UE_{jt}=0$). Wilson also obtains evidence [Wilson, 1986, secs. 5.2 and 5.4] consistent with working capital from operations being known by that time ($UWCO_{jt}=0$); this may simply indicate that noncurrent accruals are relatively predictable. Under these conditions, equation (2) can be rewritten as:

$$R_{jt}=b_0+(b_1-b_2)UCF_{jt}+u_{jt}. \tag{3}$$

The major results of recent research can be discussed within the framework of equations (1), (2), and (3).[2] Wilson [1987, table 1] estimates the equivalent of equation (3), and obtains a significantly positive coefficient. Wilson's estimates imply that $(b_1-b_2)>0$.[3] Since b_1 and b_2 represent the "response coefficients" on unexpected cash flows and unexpected current accruals, respectively, in equation (1), this result can be interpreted to indicate that the market responds more favorably to one dollar of cash flow than to one dollar of current accruals.

Wilson [1986, secs. 2 and 3] points out that the Wilson [1987] result is subject to two alternative interpretations. Given that total working capital from operations is already known, either (1) cash flows may be informative while current accruals are not ($b_1>0$; $b_2=0$), or (2) both cash flows and current accruals are informative, but differentially so ($b_1>0$; $b_2>0$; $(b_1-b_2)>0$). To distinguish between these two alternatives, Wilson [1986] reestimates equation (3), with returns data from the period surrounding the financial statement release date, simultaneously with a constrained version of equation (1), with returns data for the period surrounding the earnings announcement date.[4] Wilson [1986, sec. 5.4] finds evidence consistent with the market responding favorably to both unexpected cash flows ($b_1>0$) and unexpected current accruals ($b_2>0$), but more favorably to the former ($(b_1-b_2)>0$).[5]

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[2] Jennings [1987] considers such alternative representations of equations used to assess information in earnings components.

[3] Wilson [1987] moves immediately to a simple regression like equation (3), and so it never becomes necessary to express the coefficient in terms of differences between coefficients on earnings components, as is done here. However, the coefficient in equation (3) does have this interpretation, as shown above and in Wilson [1986, eq. (8)]. Therefore, the Wilson [1987, table 1] t-test on the coefficient (b_1-b_2) in equation (3) corresponds to the Wilson [1986, sec. 5.4] chi-square test of differences between coefficients (b_1 vs. b_2).

[4] Equation (7) in Wilson [1986] corresponds to our equation (1); however, Wilson groups all accruals into a single category, or (alternatively) excludes noncurrent accruals from the analysis. Wilson's equation (8) corresponds to our equation (3).

In summary, Wilson [1987], in combination with Wilson [1986], implies that the market responds favorably to both unexpected cash flows and unexpected current accruals, but more favorably to the former. However, there is mixed evidence on the extent to which this "preference" for cash flows over current accruals holds across other research designs. That same implication can be drawn from Bowen et al. [1987], who estimate an equation that takes on the form of equation (2), using annual returns data for 1972–1981.[6] Their results indicate that $(b_1-b_2)>0$ and $(b_2-b_3)>0$, which implies that the market responds more favorably to cash flow than to current accruals, and more favorably to current accruals than to noncurrent accruals. On the other hand, different implications can be drawn from Rayburn [1986, tables 7 and 9], who estimates a form of equation (1), using annual returns data for 1962–1982.[7] Rayburn obtains positive but approximately equal estimates of b_1 and b_2, implying no difference in the market response to cash flows and current accruals, with mixed results on noncurrent accruals.

We argue below that it is not obvious that a more favorable response to cash flows than to current accruals should necessarily hold. It is possible to construct an argument in which such a result would obtain only under certain conditions and also possible to construct other arguments in which the opposite result would be obtained. Doubts about the generality of the results are also raised by its failure to hold in Rayburn [1986], and by Wilson's own speculation [1986, pp. 188–189; 1987, p. 320] that the result might be specific to his test period.

Below, we consider alternative explanations for possible differences in the security price implications of cash flows and accruals. Some of the explanations are unconditional, and predict that the reaction to unexpected cash flows would always be larger than the reaction to accruals, or vice versa. Other explanations are less parsimonious, and permit the sign of the difference to vary across time, or across firms.

Alternative Explanations

A common basis offered for expecting differential security price implications for cash flows and accruals could be labeled a "quality of earnings" explanation.[8] A second is based on the speculation in Wilson [1986 and 1987], in which the differential price impacts vary according to macroeconomic conditions. Finally, a third explanation, in which the price impacts vary according to the specific mix of components of unexpected current accruals, is proposed.

The "Quality of Earnings" Explanation. Under the "quality of earnings" explanation, accruals have a smaller impact on prices than cash flows (or no impact at all) since accruals are either subject to manipulation (e.g., inventories), or represent only very indirect links to future cash flows (e.g., depreciation).[9] Alternatively, O'glove [1987, p. 107] argues:

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[5] To reconcile the Wilson [1986] results with our interpretation, note that Wilson's unexpected current accruals have the opposite sign of UCA_{jt}. Thus, our b_2 corresponds to Wilson's $-\delta_{CA}$; our b_1 corresponds to Wilson's δ_{CO}.

[6] Bowen et al. [1987] estimate an equation that includes the three measures of performance listed in equation (2), plus unexpected cash flow after investment. In most specifications, the latter is not significant (for example, see table 7 of that paper).

[7] Rayburn [1986] segregates noncurrent accruals into two components, deferred taxes and depreciation.

[8] References on this point include: Brealey and Myers [1981] and Healy [1985] (in Rayburn [1986]); Brealey and Myers [1981], Treynor [1972], and a Chase Financial Brochure (in Wilson [1986 and 1987]).

> Obviously, higher trending inventories in relation to sales can lead to inventory markdowns, write-offs, etc. In addition, it is important to note that an excess of inventories, time and time again, is a good indicator of future slowdown in production.

O'glove [1987, p. 107] also argues that an excess of accounts receivable

> . . . may provide a clue as to whether a company is merely shifting inventory from the corporate level to its customers because of a "hard sell" sales campaign or costly incentives. In such an instance, this type of sales may constitute "borrowing from the future."

The "quality of earnings" explanation leads to a simple, unambiguous prediction: that market prices will react more to a given amount of unexpected cash flows than the same amount of unexpected accruals. Despite its simplicity, the prediction has appeal, at least with respect to the difference between cash flows and *noncurrent* accruals. The link between future cash flows and noncurrent accruals (such as depreciation and deferred taxes) are tenuous at best. Moreover, the evidence in Wilson [1986, sec. 5.2] is consistent with the possibility that noncurrent accruals have a small or zero impact on price.

With respect to the difference between cash flows and *current* accruals, however, the logic is much less compelling. First, the link to future cash flows is much more direct for current accruals than for noncurrent accruals. Second, although the incentives and ability of managers to manipulate accounting accruals is debatable and the frequency of such manipulations is an empirical issue, it seems doubtful that systematic manipulations of current accruals are widespread.[10] Third, competing explanations predict that, under certain conditions, the sign of the difference between the coefficients of cash flows and current accruals would be the opposite of that predicted by the "quality of earnings" explanation.

To test the validity of the "quality of earnings" explanation as it applies to cash flows and current accruals, one hypothesis to be tested with the extended sample is:

$b_1 > b_2$ (coefficient on cash flows $>$ coefficient on current accruals).

There are other explanations that yield an unambiguous predictions about the sign of the difference. For example, Wilson [1987, p. 295] mentions a "liquidity" argument under which the market responds more favorably to cash flows than accruals because high liquidity is a signal of a smaller likelihood of financial distress. Our purpose here is not to provide an exhaustive list of these potential explanations; instead, we will test to see if any of the explanations with unambiguous directional predictions are consistent with the data.

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[9] The term "quality of earnings" is often used in the financial press, but is difficult to define. One detailed discussion of the term is presented in Harvard Business School Note 9-178-126, by David Hawkins and Leslie Pearlman (revised April 1985). Other sources of discussion are O'glove [1987, esp. Chap. 8], and Bernstein [1978, pp. 617-629].

To the extent that the "quality of earnings" depends on the proportion of earnings derived from recurring sources, the quality of earnings argument is related to Lipe's [1986] demonstration that the reaction to earnings components depends on their "persistence," or the strength of the relation between a shock in a given earnings component and future values of the same and other earnings components.

[10] DeAngelo [1988], Healy [1985], and Jones [1988] provide evidence consistent with management manipulation of current accruals. However, a question in these and similar studies is whether the research design properly controls for the nondiscretionary portion of accruals. McNichols and Wilson [1988] attempt to do this with one current accrual—the provision for bad debts—and conclude that only a small portion of the variation in this account is discretionary.

The Macroeconomic Conditions Explanation. Wilson [1986, pp. 188-189; 1987, p. 320] noted that the 1981-1982 period during which he found a greater impact on security prices for unexpected cash flows than for unexpected current accruals was a period of economic downturn. He then speculated that perhaps these differential security price reactions are attributable to how well firms anticipate and adjust to changing economic conditions. As the economy contracts, the market would react favorably when management liquidates noncash working capital, which would manifest itself as a "preference" for cash flow over current accruals. Thus, the prediction is:

$b_1 > b_2$ (coefficient on cash flow > coefficient on current accruals) in an economic contraction.

In contrast, during an expansion, the market would react favorably when management uses cash to increase noncash working capital, and we have:

$b_1 < b_2$ (coefficient on cash flow < coefficient on current accruals) in an economic expansion.

A second hypothesis tests whether the sign of $(b_1 - b_2)$ depends on the unexpected component of GNP. Since economic expansion and contraction is also related to interest rates, the unexpected component of interest rates is considered as an alternative conditioning variable.

The Mix of Components of Unexpected Current Accruals Explanation. Under this explanation, the relative security price impact of cash flows versus accruals is generally indeterminate; that is:

$b_1 > b_2$ *or* $b_1 < b_2$ (coefficient on cash flow is greater *or* less than coefficient on current accruals) depending on the specific mix of current accruals.

Consider the following decomposition of current accruals:

current accruals =
increases in inventories
+ increases in receivables
− increases in payables.

Using this identity, an alternative to equation (1) decomposes the term pertaining to unexpected current accruals, $b_2(UCA)$, so as to explicitly identify unexpected changes in inventories, receivables, and payables (denoted *UINV*, *UREC*, and *UPAY*) as follows:

$$R_{jt} = b_0 + b_1(UCF_{jt}) + b_{2I}(UINV_{jt}) + b_{2R}(UREC_{jt}) + b_{2P}(UPAY_{jt}) + b_3(UNCA_{jt}) + w_{jt}. \quad (4)$$

Abstracting from the competing theories described above, the maintained hypothesis would be that all the coefficients in equation (4) are the same.[11] Below, we consider whether the coefficients on these components of unexpected current accruals should differ from one another, from the coefficient on unexpected current accruals, and from the coefficient on unexpected operating cash flows (i.e., whether $b_{2I} = b_{2R} = b_{2P} = b_2 = b_1$).

Just prior to the release of financial statements, net earnings are already known. Thus, the unexpected components of cash flows and accruals that become known at the financial statement release date must sum to zero or:

$$UCF_{jt} + UINV_{jt} + UREC_{jt} + UPAY_{jt} + UNCA_{jt} = 0 \quad (5)$$

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[11] Our maintained hypothesis also abstracts from other reasons why stock price response coefficients might vary across earnings components, such as Lipe's [1986] notion of persistence.

where expectations for each are based on information revealed through the earnings announcement date.

Substituting equation (5) into equation (4) yields:

$$\begin{aligned} R_{jt} = b_0 &+ (b_{2I} - b_1) UINV_{jt} \\ &+ (b_{2R} - b_1) UREC_{jt} \\ &+ (b_{2P} - b_1) UPAY_{jt} \\ &+ (b_{2R} - b_1) UNCA_{jt} + w_{jt}. \end{aligned} \tag{6}$$

Since inventories, receivables, and payables support the ongoing operations of the firm, there should be a relation between the balances in such current operating accounts and future sales levels. Section V considers how such a relation might arise from a simple model of the operating cycle, and describes the factors that would determine the signs of $(b_{2I} - b_1)$, $(b_{2R} - b_1)$, and $(b_{2P} - b_1)$. This model suggests that the differences in security price implications of cash flows and current accruals may be due to what they reveal about managers' beliefs concerning future sales levels (or the demand for a firm's products). Because the directional prediction for the stock price reaction to the inventory component of current accruals in equation (6) differs from that of the two explanations above, it can be empirically distinguished from competing explanations.

The three arguments presented in this section are not the only possible reasons why valuation implications could differ between cash flows and current accruals or why they could vary across the components of current accruals. Other possible explanations could be based, for example, on more refined notions about "earnings quality" under alternative accrual accounting methods (e.g., LIFO vs. FIFO). Alternatively, the context might be important (e.g., a decrease in inventories may have favorable security price implications if it results from attempts to improve the inventory system).[12] If the security price implications of cash flows and accruals are too highly dependent on the specific context in which they occur, then the tests summarized in this paper will be unlikely to provide evidence consistent with the predictions summarized above.

II. Data and Expectations Models

Sample Selection

The sample consists of all corporations that filed quarterly and annual reports with the SEC from 1976 (when SEC registrants were first required to furnish quarterly balance sheet data in addition to quarterly income statement data) through 1985 and for which the required data were available. The required data fell into three categories.

1. *Quarterly earnings, sales, funds flow, and balance sheet data.* Data for the 1976–1984 period were available on COMPUSTAT II, and provided a quarterly time-series of 36 observations for each firm which, due to differencing, allowed estimation of expectations models for accounting variables over the test period 1977–1984.

2. *Earnings announcement dates and information release dates for 10-Qs, 10-Ks, and annual reports.* Release dates for these reports were obtained from *The Wall Street Journal* and from computer files maintained by the SEC.[13]

To maintain a clear separation between the effects of earnings announcements and the effects of financial statement releases, Wilson [1987, p. 299] used only observations with at least eight days separating these two events. He reports that for over 90 percent of his observations, at least eight days separated the earnings announcement date and the first date that either the annual report or the 10-K arrived at the SEC. For the fourth quarter releases in our sample, 89.7 percent of these dates were separated by at least eight trading days (90.3 percent in Wilson). Following Wilson, observations are excluded if there were fewer than eight days between the two dates. For the observations remaining, the mean and the median number of trading days between those dates in the fourth quarters of firms fiscal years were 25 and 24, respectively, both in the full 1977–1984 sample period and in the 1981–1982 subperiod. The mean and the median were 17 and 15 days, respectively, for all observations, including fiscal quarters one through three, indicating that 10-Q reports follow earnings announcements more closely than is the case for year-end reports.

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[12] Another example is provided by Stober [1986], who describes how information from financial statement notes about LIFO inventory liquidations might be used to assess the "quality of earnings" previously reported. Consistent with the above predictions, this explanation leads to the view that unexpectedly low inventory balances for LIFO firms are "bad news."

[13] We appreciate the efforts of Peter Easton and Mark Zmijewski, who obtained this data from the SEC and made a portion of it available to us. We conducted a series of reasonableness tests on the financial statement release dates, but excluded only 0.5 percent of the data from consideration on that basis.

3. *Daily stock returns data.* These data were obtained from the CRSP database.

There were 177 firms for which the required COMPUSTAT II data for the period 1976–1984 were available, and which were also listed on CRSP for the period 1977–1984. Of these firms, 170 were located on the SEC computer file of financial statement release dates. For some of these firms, CRSP returns were missing for some days during 1977–1984. Also, financial statement release dates were not available for some quarters. Thus, while 170 firms potentially represent 5,440 quarterly observations over an eight-year period, the actual number of usable observations was fewer. Approximately ten percent of the firms were also included in the Wilson [1986 and 1987] sample of the fourth quarters of 1981 and 1982 only.

Measures of Funds from Operations

The tests required measures of cash flow from operations and working capital from operations, but these data were not available on COMPUSTAT II for years before 1984. Thus, these amounts were constructed by using income statement and balance sheet data as follows:

Working capital from operations
=Operating income before depreciation
−Interest expense
−Current portion of income tax expense.

Cash flow from operations
=Working capital from operations
−Increase in net working capital other than cash and securities, net of short-term debt.

The correlations between our measures of working capital from operations (scaled by total assets), and those actually reported by the firms for the four quarters of fiscal 1984 are .80, .75, .81, and .75.[14] Except for the inability to segregate current income tax expense into operating and nonoperating segments, the measure used is one that could have been reported by firms as working capital from operations, in accordance with GAAP. The benefit of our measure is that it is calculated consistently across firms, while the measures actually reported by firms are not (see Ketz and Largay [1987]). In fact, inconsistency in reporting practices across firms is a likely explanation for our inability to approximate the reported numbers with greater precision.

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[14] Four alternatives yielded similar results. They were: (1) income before special items, nonoperating items, and extraordinary items, plus depreciation and deferred taxes; (2) income before nonoperating items and extraordinary items, plus depreciation and deferred taxes; (3) income before special items and extraordinary items, plus depreciation and deferred taxes; and (4) operating income before depreciation.

Firms' Information Release Policies

Although the first date on which cash flow and accrual data are publicly available typically coincides with the financial statement release date, some firms reveal these data in news releases at some prior time. These firms should be excluded from tests on the period surrounding the financial statement release date.

To ascertain when the sample firms first released financial statement information to the public, a news release survey similar to that of Wilson [1987] was conducted. Because it would be difficult to obtain news release copies for the entire 1977–1984 period, only news releases announcing earnings for firms' most recent fiscal years were requested: one announcing fourth quarter earnings and one pertaining to a quarter other than the final quarter of the fiscal year. For the final sample, 137 out of 170 (81 percent) responded. This identified the firms that, in 1986, furnished data sufficient to calculate funds flow measures prior to financial statement release, and excluded those firms from tests that focus on the period surrounding the financial statement release date, on the assumption that the same disclosure policy had been in effect since 1977.[15,16]

Identification of the date at which interim financial statement data first became available presented a special problem, since the sample firms issued both 10-Qs and quarterly reports to shareholders (QR/Ss), but release dates are available only for the former. Firms were asked to indicate whether they released the QR/S prior to the week during which the 10-Q was released. The 38 firms that answered in the affirmative (27.7 percent) were eliminated from tests which focus on the period surrounding the release of interim financial statements.

Expectations Models

To replicate Wilson [1987], we estimate expectations models for cash flow and working capital from operations (after the earnings announcement date) using Wilson's method. Wilson applied OLS estimation to a pooled cross-section of firms, which assumes that model parameters are the same for all firms. The independent variables used in these expectations models are listed in Table 1. Since we have more data than Wilson, we modified his approach by estimating the same models not only in a single pooled cross-section but also in industry-based pools, which permit the model parameters to vary industry-by-industry. This was implemented by grouping the sample into 33 industries primarily on the basis of two-digit COMPUSTAT industry codes.

Table 1 also contains summary statistics on the goodness of fit for the expectations models and compares their performance here to that in Wilson's [1987] sample. Where the expectations models

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[15] Since our understanding is that early disclosure of these data were less common in prior years, we view this assumption as conservative. However, following Wilson [1986 and 1987], we assumed that any firm not responding did not reveal detailed financial statement data prior to the release of the financial statements.

[16] For the release of annual financial statements, the date at which financial statement information is first publicly available would ordinarily be the earlier of the release date of the annual report to shareholders (AR/S) or the date at which the 10-K report is received at the SEC. We were able to identify dates that the SEC received 10-K reports and annual reports (as well as the dates it received definitive proxy statements, which must be accompanied by an annual report). However, of the firms responding to the news release survey, 37 (27.0 percent of the sample) stated that they typically mail a separate fourth-quarter report to shareholders prior to mailing the annual report; we excluded these firms from tests which focus on the period surrounding the AR/S release.

TABLE 1

SUMMARY OF EXPECTATIONS MODELS USED IN REPLICATION OF WILSON [1987]

Independent variables used in prediction of quarter t *values of cash from operations, or working capital from operations (all variables scaled by total assets).*

Values already announced for quarter t:	Sales Net Earnings
Values reported previous quarters: (values for quarter $t-1$; sum of values for quarters $t-2$ and $t-3$; values for quarter $t-4$)	Sales Cash from operations Current accruals Noncurrent accruals
Value for annual period including quarter t:	Capital expenditures

Summary Statistics for Estimation of Expectations Models:

Dependent Variable:	*Cash from Operations*			*Working Capital from Operations*		
	Wilson[a]	*This Study*		*Wilson*[a]	*This Study*	
	1981–1982 4th Qtr.	*1981–1982 4th Qtr.*	*1977–1984 All Qtrs.*	*1981–1982 4th Qtr.*	*1981–1982 4th Qtr.*	*1977–1984 All Qtrs.*
Expectations Models Estimated in Pooled Cross-Section:						
Number of Observations	463	209	2,594	463	209	2,594
R-squared	.47	.52	.40	.66	.74	.65
Residual autocorrelations:						
lag 1	—	—	.04	—	—	−.00
lag 2	—	—	.02	—	—	.00
lag 3	—	—	−.00	—	—	−.05
lag 4	—	—	−.15	—	—	−.03
Expectations Models Estimated in Time-Series, Industry-by-Industry:						
Number of observations						
Minimum:	N/A	N/A	32	N/A	N/A	32
Maximum:	N/A	N/A	480	N/A	N/A	480
R-squared (median across industries):	N/A	N/A	.48	N/A	N/A	.83
Residual autocorrelations (estimated in pooled data set):						
lag 1	—	—	.05	—	—	−.03
lag 2	—	—	.01	—	—	.01
lag 3	—	—	−.03	—	—	−.03
lag 4	—	—	−.05	—	—	−.02

[a] Results reported in Wilson [1987, p. 307].

are estimated in pooled cross-section (the approach used by Wilson), the R^2s of these models in our sample during the time periods studied by Wilson [1987] are higher than those reported by Wilson. The explanatory power of these pooled cross-sectional models falls off somewhat when estimated over the entire 1977–1984 time period; however, the expectations models estimated on an industry-by-industry basis exhibit a greater degree of explanatory power, on average, than those estimated in pooled cross-section. Table 1 also shows that there is very little residual autocorrelation under either approach, indicating that these expectations models are efficient forecasters of funds from operations. Finally, note that the functional form of the expectations models used here is precisely the same as that used in Wilson [1986 and 1987] so that this feature of our design should not create any differences between our results and those of Wilson.

III. REPLICATION AND EXTENSION OF WILSON [1987]

The empirical tests to replicate and extend the work of Wilson [1987] assume that any difference between the stock price implications of cash flows and current accruals is the same for all firm-periods. Thus, the tests can be viewed as emanating from the "quality of earnings" explanation and others in which the sign of the difference is unconditional.

Following Wilson, the event period is the nine-day interval surrounding the release date of reports to shareholders. The procedures used to identify event dates and estimate key variables mimic those used by Wilson as closely as possible. The primary differences were as follows. First, while Wilson's tests were based only on fourth quarter data taken from the annual reports to shareholders (AR/S), our tests were based on data from all fiscal quarters, taken from both interim and annual reports.[17] Second, while Wilson's sample was restricted to firms with SIC codes 1000–4800, 20 percent of the present sample includes firms from wholesaling, retailing, and services (SIC 5000–8900). Third, our measures of funds from operations were constructed from income statement and balance sheet data, whereas Wilson's were taken directly from the statement of changes in financial position.

In this section the primary interest is in the following equation, which corresponds to equation (3) of Section I:

$$R_{jt}=c_0+c_1 UCF_{jt}+z_{jt}, \qquad (7)$$

where:

R_{jt} = the accumulated market model prediction error[18] for firm j during the nine-day window surrounding the release of financial statements for quarter t, and

UCF_{jt} = unexpected cash flow from operations for firm j, quarter t, scaled by total assets at the end of quarter $t-1$, where expectations are conditional on information released through the earnings announcement date (see Table 1 for the expectations model).

Except for differences in the notation, equation (7) above is the identical to equation (2) of Wilson [1987] when he uses unexpected cash from operations as the independent variable. If we assume, based on Wilson's evidence [1986, sec. 5.2] that working capital from operations is essentially known by the market as soon as earnings are announced, c_1 is equal to (b_1-b_2) in equation (3).

On the other hand, if we allow for the

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[17] Following Wilson, we use the AR/S release date as the financial statement release date in our replication. We also conducted tests using the earlier of the AR/S release date and the date the 10-K report is received at the SEC as the financial statement release date.

[18] To maintain comparability with Wilson [1987], market model parameters were estimated during a 120-day estimation period, from trading day $t-210$ to $t-91$, where t denotes the last trading day in the quarter for which earnings and funds flow information is reported. Thus, the market model estimation period does not overlap with any of the period to which the accounting data used to compute unexpected funds flow pertains.

possibility that there is some uncertainty about working capital from operations after earnings have been announced, there is motivation for using unexpected working capital from operations in an equation like Wilson's. In the present notation, this equation would be:

$$R_{jt}=d_0+d_1 UWCO_{jt}+z_{jt}, \qquad (8)$$

where $UWCO_{jt}$ is the unexpected working capital from operations for firm j, quarter t, scaled by total assets at the end of quarter $t-1$, and expectations are conditional on information released through the earnings announcement date.

Although Wilson finds no evidence of uncertainty about working capital from operations once earnings have been announced, we present estimates of equation (8) for completeness. The coefficient d_1 in equation (8) should be interpreted as the difference between the price response coefficients on working capital from operations and its complement, noncurrent accruals. However, if the value of $UWCO_{jt}$ (excluding measurement error) is close to zero for all firms, we will be unable to estimate this coefficient with precision.

Table 2, panel A presents the results of Wilson's estimation of equations (7) and (8). He obtained a significantly positive regression coefficient on unexpected cash flow from operations, suggesting that the market reacts favorably upon learning that the amount of earnings that arrived in the form of cash flow (rather than accruals) is higher than expected. Wilson obtained an even larger positive coefficient on unexpected working capital from operations but, given that it was estimated so imprecisely, he was unable to reject the hypothesis that the underlying parameter equals zero at conventional levels.

Panels B and C of Table 2 summarize the portion of the replication that includes only data from the fourth quarters of 1981 and 1982 used in Wilson [1987]. Panel B contains the results based on the statistical method used by Wilson. Under that approach, the expectations models for cash flows and working capital from operations are estimated by pooling all sample firms together. The approach in panel C differs, in that expectations models are estimated within industry pools.

In general, although the results reported in panel B are not as strong as Wilson's, they do not contradict his results. In the regression of market model prediction errors against unexpected cash flow from operations, the coefficient is about three-fourths as large as Wilson's. The difference in significance levels reflects, in part, less precision in our estimate, which in turn is partially due to the smaller sample size. If all else remained constant while the sample size was expanded to the size of Wilson's, our t-statistic would be 1.68; if our coefficient remained constant while attaining Wilson's degree of precision in estimation, the t-statistic would be 2.43.

In the regression of market model prediction errors against unexpected working capital from operations, the coefficient estimate is nearly identical to Wilson's, and like Wilson's coefficient, it is not statistically significant at conventional levels. Finally, in panel C, our results based on industry-specific expectations models indicate an even weaker relation between unexpected funds flow and stock returns than those based on expectations models estimated over the entire sample.

Our use of income statement and balance sheet data (rather than data from the statement of changes in financial position) to calculate cash flow from operations could explain why the esti-

Table 2

Regressions of Abnormal Stock Returns During the Financial Statement Release Period Against Unexpected Funds Flow

Test period: Fourth Quarters of 1981 and 1982

Panel A. Results as Reported in Wilson [1987][a]:

	Funds Flow Variable: Cash Flow from Operations	*Funds Flow Variable: Working Capital from Operations*
Coefficient	.23	.26
t-statistic	3.26	1.10
R-squared	.029	.001
n	325	325

Panel B. Results of Wilson's Method Applied to New Sample—Expectations Models Estimated in Pooled Cross-Section:

	Funds Flow Variable: Cash Flow from Operations	*Funds Flow Variable: Working Capital from Operations*
Coefficient	.17	.25
t-statistic	1.17	.62
R-squared	.009	.002
n	158	158

Panel C. Results Based on New Sample—Industry-Specific Expectations Models:

	Funds Flow Variable: Cash Flow from Operations	*Funds Flow Variable: Working Capital from Operations*
Coefficient	.13	.10
t-statistic	0.89	.22
R-squared	.005	.000
n	158	158

[a] As originally reported, Wilson's coefficients were based on a regression where the dependent variable is the average daily abnormal return. To make the coefficient comparable with our results, where the dependent variable is a nine-day cumulative abnormal return, Wilson's coefficients are multiplied by nine.

mated coefficient is smaller than Wilson's. However, as discussed in Section II, our approach conforms closely to that which firms could follow under GAAP and our measure (unlike Wilson's) has the virtue of not being influenced by the frequent inconsistencies in how firms measure cash flows from operations. Note also that, although Wilson's coefficient is significant while ours is not, the difference between Wilson's coefficient and ours is statistically insignificant at conventional levels.

It is also possible that we were unable to replicate Wilson's result more closely because we have included nonindustrial firms, while Wilson did not. To ascertain whether restricting the sample to industrial firms would alter these comparisons, we conducted supplemental analyses analogous to those in panel B on only those firms from industries with

TABLE 3

REGRESSIONS OF ABNORMAL STOCK RETURNS DURING THE FINANCIAL STATEMENT RELEASE PERIOD AGAINST UNEXPECTED FUNDS FLOW (1977–1984)

Panel A. Results of Wilson's Method Applied to New Sample—Expectations Models Estimated in Pooled Cross-Sections:

	Funds Flow Variable: Cash Flow from Operations			*Funds Flow Variable: Working Capital from Operations*		
	All Quarters	*Fourth Quarters Only*	*Fourth Quarters 1981–1982*	*All Quarters*	*Fourth Quarters Only*	*Fourth Quarters 1981–1982*
Coefficient	−.05	−.02	.17	−.02	.11	.25
t-statistic	−1.42	−.31	1.17	−.19	.69	.62
R-squared	.001	.000	.009	.000	.001	.002
n	2,401	662	158	2,401	662	158
t-*statistics by Firm Size Quintile:*						
1 (smallest)	−1.59	−1.18	.65	−.11	1.28	1.62
2	−.84	1.46	1.87	.27	.29	−.10
3	1.30	−.03	−.33	.57	−.02	−1.40
4	−1.64	−.35	−.21	−.15	−.40	−2.30
5 (largest)	0.44	−.18	.27	−.72	.26	2.28

Panel B. Results Based on New Sample—Industry-Specific Expectations Models:

	Funds Flow Variable: Cash Flow from Operations			*Funds Flow Variable: Working Capital from Operations*		
	All Quarters	*Fourth Quarters Only*	*Fourth Quarters 1981–1982*	*All Quarters*	*Fourth Quarters Only*	*Fourth Quarters 1981–1982*
Coefficient	−.06	−.03	.13	−.08	.02	.10
t-statistic	−1.63	−.39	.89	−.62	.10	.22
R-squared	.001	.000	.001	.000	.000	.000
n	2,399	662	158	2,400	662	158
t-*statistics by Firm Size Quintile:*						
1 (smallest)	−2.24	−1.99	−1.17	.06	.84	1.05
2	−.96	1.26	2.05	−1.20	−.96	−.87
3	1.22	.61	.08	.62	.23	−.30
4	−.96	.07	.38	−.14	.13	−.64
5 (largest)	0.12	−.15	1.25	−.63	.18	1.95

SIC codes 1000–4800, resulting in 29 fewer observations. The coefficients and degree of explanatory power in these regressions were similar to those in panel B and the *t*-statistics declined in accordance with the reduction in sample size.

Although the tests for the fourth quarters of 1981 and 1982 are based on fewer firms than those in Wilson [1987], the database permits examination of whether Wilson's results are specific to the time period that he examined. A set of results for the entire time period 1977 through 1984 is presented in Table 3. Wilson's method (expectations models estimated over the entire sample) is applied in panel A, while expectations models estimated on an industry-by-industry basis are used in panel B. Results are presented for all firm-quarters combined, separately for the fourth quarters of firms' fiscal years,[19] and for the 1981–1982 fourth quarters. In Table 3, even in regressions with over 2,400 firm-quarters of observations, none of the coefficients on unexpected funds flow in the 1977–1984 period is significantly different from zero. Note also that, if the market responds more favorably to unexpected funds flow than to the complementary unexpected accruals, one would expect the coefficients reported in Table 3 to be positive but, in fact, most of the coefficients for periods other than the 1981–1982 fourth quarters are negative.

Wilson's tests were also extended by considering firm size. Freeman [1987] and Atiase [1985] indicate that, for large firms, there exist private information sources more timely than accounting reports; thus, one would not expect the published financial statements of large firms to convey as much new information to the market as those of smaller firms. The *t*-statistics for results stratified by firm size are also presented in Table 3. There is no obvious pattern in the results across the different size classes.[20] In particular, there is no evidence that information about unexpected cash flows/accruals was more likely to be impounded in market prices for small- and medium-sized firms than for large firms during the period surrounding the release of the annual report.

Finally, these tests were modified in several other ways—deletion of outliers,[21] use of market-adjusted returns instead of market model prediction errors, and centering the event window around the earlier of the 10-K or the AR/S release dates, instead of around AR/S release dates. None of these modifications altered the conclusions. Thus, in general, we found no systematic evidence that unexpected funds flows or accruals would explain stock price behavior in short windows surrounding the release of financial statements outside of the fourth quarters of 1981 and 1982.

IV. Tests of Whether Valuation Implications Vary According to Macroeconomic Conditions

This section describes tests of Wilson's conjecture that his result might extend only to periods of economic downturn, and that the opposite result would be obtained in periods of economic improvement. The 1977–1982 period was partitioned into three regimes, using each of two proxies for unexpected changes in the state of the economy. The proxies used are the unexpected components of real GNP and of short-term interest rates (on 90-day Treasury bills). The prediction is that when GNP growth is unexpectedly low, or interest rates are unexpectedly high for the quarter just ended, the market would respond favorably around report release dates to those firms that contemporaneously liquidated current working capital accounts and, thus, generated more cash from operations. Thus, during such a regime, we would expect a positive coefficient on unexpected cash flows from operations in equation (7). In contrast, when GNP is unexpectedly high, or interest rates are unexpectedly low, we would expect that same coefficient to take on a negative sign.

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[19] There are two motivations for reporting separate results for the fourth quarters of firms' fiscal years. First, whereas fourth-quarter accruals are audited, interim accruals are not. Second, we have more confidence in our financial statement release dates for the fourth quarter. For the vast majority of observations, we have both annual report and 10-K release dates, but for interim releases, we have only 10-Q dates. We rely on questionnaires to exclude firms that tend to issue quarterly reports before 10-Qs are released (see Section II).

[20] Significant *t*-statistics for the largest firms would be contrary to our expectations about the effects of firm-size on the amount of new information conveyed by financial statements. Although there are some significant negative *t*-statistics for the smallest sized firms, a negative relation between unexpected funds flow and abnormal stock returns would be inconsistent with the results reported in Wilson [1987, p. 308, note 32].

[21] For these tests, we deleted observations where the absolute value of *UCF* was greater than eight percent of total assets (representing approximately three percent of the sample) and observations where the absolute value of *UWCO* was greater than four percent of total assets (representing approximately one percent of the sample). These cutoffs were determined after visual inspection of distributions of these variables; the lower value of the cutoff for *UWCO* reflects the relatively greater predictability of working capital from operations.

The unexpected components of real GNP and interest rates were identified by fitting time-series models to the data.[22] The 11 quarters with the most negative unexpected components were placed in one regime; the 11 with the most positive make up another and the remaining 10 quarters constitute a third regime. We then followed the same estimation approach used in Table 3, except that both the expectations models for cash from operations and the final regressions were estimated within regimes.[23]

Because Wilson's [1987, p. 320] conjecture arose from observing that the fourth quarters of 1981 and 1982 he studied were part of a period "when the economy was in a severe downturn (1981–1982)," it is of interest to know how these two quarters would be classified on the basis of our proxies for the state of the economy. For the partition based on unexpected interest rates, both these quarters fall in the regime where we would expect a positive coefficient in equation (7), meaning that interest rates were unexpectedly high in both of these quarters. In contrast, for the partition based on real GNP, only the fourth quarter of 1981 falls in the regime where we would expect a positive coefficient (meaning that real GNP growth was unexpectedly low in this quarter); in the fourth quarter of 1982, unexpected real GNP growth was near zero, thus allowing no prediction as to the coefficient's sign.

Table 4 summarizes the results based on partitioned data. There is clearly no support for the predictions. The coefficients take on the "wrong" signs as frequently as the "right" ones; they are never statistically significant and the R^2s are all less than .01. Similar conclusions are reached using an event window centered around the earlier of the 10-K or annual report date for fourth quarter reports (as opposed to using annual report dates only), or when market-adjusted returns are substituted for market model prediction errors.[24]

In Table 4, contemporaneous values of unexpected GNP growth were used to partition time periods according to the present state of the economy. However,

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[22] The time-series models were estimated with quarterly data. For the short-term interest rate series, a simple random walk model fits well. For real GNP, the raw series used was already seasonally adjusted and a Box-Jenkins IMA(1,2) model eliminated most of the remaining serial dependence. For GNP, observations are available only for quarters ended in March, June, September, and December. Firms with fiscal quarters ended in other months were matched with the nearest calendar quarter available. Since an interest rate for a 90-day T-bill is available at the end of any month, it was always possible to match an observation to any given fiscal quarter.

[23] The improvement in fit obtained from permitting the coefficients of the expectations models for cash flow from operations to vary by regime is small; the overall R-squared for expectations models estimated in pooled cross-section rises from .40 to .42 when we partition on either unexpected GNP or unexpected interest rates.

[24] We also attempted another partition, based on levels of interest rates. Motivation for this approach is provided by Collins and Kothari [1988], who show that earnings response coefficients vary inversely with the level of interest rates. If the coefficient c_1 in our model depends on the level of interest rates, then equations (7) and (8) are random coefficients models and pooling observations across different interest rate regimes would reduce the efficiency of the estimators. However, results of using this partition did not alter the conclusions.

TABLE 4

REGRESSIONS OF ABNORMAL STOCK RETURNS DURING THE FINANCIAL STATEMENT RELEASE PERIOD AGAINST UNEXPECTED FUNDS FLOW: EFFECTS OF PARTITIONING ON MACROECONOMIC CONDITIONS (1977–1984)

Panel A. Expectations Models Estimated in Pooled Cross-Sections—Within Economic Regimes:

Predicted Sign of Coefficient:	*Positive*		*No Prediction*		*Negative*	
State of Economy:	*Unexpected GNP Growth Low*	*Unexpected Interest Rates High*	*Unexpected GNP Growth Near Zero*	*Unexpected Interest Rates Near Zero*	*Unexpected GNP Growth High*	*Unexpected Interest Rates Low*
Coefficient	−.06	−.07	.00	−.01	−.10	−.01
t-statistic	−.94	−1.26	.06	−.13	−.49	−.23
R-squared	.001	.002	.000	.000	.003	.000
n	846	883	748	666	807	852

Panel B. Industry-Specific Expectations Models—Estimated within Economic Regimes:

Predicted Sign of Coefficient:	*Positive*		*No Prediction*		*Negative*	
State of Economy:	*Unexpected GNP Growth Low*	*Unexpected Interest Rates High*	*Unexpected GNP Growth Near Zero*	*Unexpected Interest Rates Near Zero*	*Unexpected GNP Growth High*	*Unexpected Interest Rates Low*
Coefficient	−.10	−.06	−.12	−.00	−.13	−.06
t-statistic	−1.38	−.86	−1.47	−.00	−1.70	−.79
R-squared	.002	.001	.003	.000	.004	.001
n	817	848	719	645	775	819

Fama [1981] observes that common stock returns tend to lead measures of real output such as GNP. To the extent that stock prices react to the future course of the economy, partitions based on realized future GNP growth rates may provide better tests of the Wilson conjecture. Tests were conducted with the partitions based on unexpected real GNP for quarter $t+1$, but the conclusions did not change. Neither did they change the data partitioned on the basis of realized annual growth rates in real GNP for the year ended in quarter $t+4$.

Despite the failure to find support for the Wilson conjecture, it is possible that the coefficients of equation (7) do vary according to the state of the economy but that we have improperly partitioned the time periods into economic regimes. To assess the likelihood of that possibility, one final test was conducted. Here, the null hypothesis is that the coefficients for *each* quarter are the same. The approach used is a standard test of linear restrictions on a coefficient vector (see Theil [1971, eq. 7.23]). The resulting test statistic should be distributed as an $F(62, 2337)$ under the null hypothesis. The observed value of the test statistic is .99; a value at least this large would be observed by chance approximately 50 percent of the time. This failure to find any significant differences in the coefficients of equation (7) across time suggests that further attempts to document time-varying coefficients are not likely to be fruitful.

V. POTENTIAL LINKS THROUGH FUTURE SALES: A SIMPLE MODEL OF THE INFORMATION IN CURRENT ACCRUAL COMPONENTS

The third explanation to be considered is that the stock price implications of cash flows and current accruals vary across firms according to their specific mix of current accrual components. A simple model of the operating cycle permits prediction of the signs of the coefficients in equation (6). Because current period sales are always disclosed prior to or at the time information on current accruals is released, we consider whether (and how) current accruals could provide information about *future* period sales incremental to that in *current* period sales. A formal description of this model is provided in the Appendix. This section describes the model's essential features, its empirical implications, and some evidence on the predictive links.

Changes in Inventory Balances

The model in the Appendix segregates inventory into two components: (1) the optimal inventory balance, given management's expectation of future sales, and (2) the deviation from this balance. The second component includes inventory "buildups" and "liquidations" that arise as a function of deviations of prior sales from expectations. Now consider investors who have already received announcements of earnings and sales for the period, and who are awaiting disclosure of the inventory balance in the published financial statements. Since sales are known, the market is already aware of the second component's magnitude: the deviation from the optimum due to imperfectly anticipated sales volume. The market also has some (imperfect) estimate of management's expectation of period $t+1$ sales, and uses that to form its own (imperfect) estimate of the optimum, given management expectations. Upon publication of the actual inventory balance, the market can determine this remaining component with certainty, and can infer management's beliefs about future sales. Higher than expected inventory signals higher future sales, which should typically have favorable implications for firm value. In other words, given that sales and earnings are already known, the market would react favorably upon learning that the portion of earnings coming in the form of inventory (rather than cash) is higher than expected. This implies that in equation (6):

$b_1 < b_{2I}$ (coefficient on cash flow < coefficient on inventories).

It is important to note that the expected inventory balance is conditioned on knowledge of current period sales. If it were not, higher than expected inventory could simply reflect an inventory buildup resulting from an unanticipated decline in customer demand, which would presumably be a negative signal. That would stand in direct contrast to the prediction made here, and would be consistent with predictions based on the "quality of earnings" explanation.

Changes in Receivables Balances

Upon receipt of sales and earnings information, the market can form expectations for the receivables balance. The subsequent announcement of end-of-period receivables reveals unexpected receivables (*UREC*). If *UREC* is negative (because collections were unexpectedly low, and/or receivables unexpectedly high), it could imply either of the following. First, it may reveal that management was able to generate the previously announced sales volume only by relaxing credit policy and/or "borrowing sales from the future" (as argued by O'glove [1987, p. 107]). Second, it may reveal that customers have become less willing or able to pay quickly. We would view both of these as negative signals about the value of the firm; *however, these implications for firm value may or may not operate in terms of changes in expected future sales*. Nevertheless, contrary to the case of unexpected inventories, this leads to the prediction that, in equation (6):

$b_1 > b_{2R}$ (coefficient on cash flow > coefficient on receivables).

In this case, the directional prediction of our model is the same as that under the "quality of earnings" explanation.

Changes in Payables Balances

The third major remaining component of current accruals consists of changes in accounts payable. The payables balance could reveal information about two things. First, since payables are a function of inventory purchases, changes in payables balances provide a (redundant) signal about management's expectations of future sales. Second, payables balances provide a signal about unexpected changes in the pace of "retiring" this form of debt. The possible implications of the second signal for share values are unclear to us. Thus, we conduct tests on the full model (eq. (6)), and a version of the model including only changes in inventory and receivables balances, excluding payables.

The Importance of Segregating the Components of Current Accruals

Prior studies may have lost much of the information available in current accruals by treating them collectively. Our analysis suggests that changes of the same sign in receivables and inventory may have opposite impacts on share values. Also, unexpected changes in inventory and unexpected changes in payables may both provide information about future sales, but that information may be lost when the two accounts are offset against each other by grouping current accruals. Thus, if the components of current accruals convey information about future sales, then holding working capital from operations constant, *aggregate* current accruals may have ambiguous implications for valuation.

Evidence on Links in the Model

Tests of our model require expectations models for sales, inventories, receivables, and payables. These expectations models, described in Table 5, were estimated from data pooled within industries and include some firm-specific parameters to take care of within industry variation. The unexpected components of the inventory and receivables balances as of the end of quarter t are defined as those not predictable on the basis of inventory and receivables balances through quarter $t-1$ and sales through quarter t; the models allow for seasonality in sales and in the relation of inventory and receivables to sales.[25]

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[25] Due to concerns about efficiency of the parameter estimates, we also reestimated the expectations models for inventories and receivables assuming the seasonal adjustment parameters k_{1q} and p_{3q} (see Appendix) were the same for all four quarters with no change in the results.

TABLE 5

SUMMARY OF EXPECTATIONS MODELS USED IN SECTIONS V AND VI

Dependent Variable:	*Sales* (S_t)	*Inventory* (I_t)	*Receivables* (R_t)	*Payables* (P_t)
Model estimated in:	Seasonal differences (S_t-S_{t-4})	Levels	Levels	Levels
Independent variables:	$(S_{t-1}-S_{t-5})$	I_{t-1} $E_t(S_{t+1})$ $E_{t-1}(S_t)$ $S_t-E_{t-1}(S_t)$ (See Appendix)	R_{t-1} S_t (See Appendix)	P_{t-1} P_{t-4} I_t R_t
Approach to pooling:	Data pooled within industries[a]	Data pooled within industries[b]	Data pooled within industries[c]	Data pooled within industries
Approach to scale specific firms' data to mitigate heteroscedasticity	Two-stage Weighted Least Squares	Scale all data by sales	Scale all data by sales	Scale all data by sales
R-squared (for median industry):	.58	.92	.77	.71
Residual autocorrelations (estimated in pooled data set):				
lag 1	.06	.10	−.06	−.05
lag 2	.10	−.00	−.02	.11
lag 3	.07	−.00	.06	.03
lag 4	−.32	.13	−.06	.28

[a] Intercept (drift term) is permitted to vary by firm; slope coefficient is assumed constant across firms within industry.

[b] Coefficient on $E_t(S_{t+1})$ reflects firm-specific and seasonal variation (see Appendix). Otherwise, all coefficients are assumed constant across firms within an industry.

[c] Coefficient on R_{t-1} reflects firm-specific and seasonal variation (see Appendix). Otherwise, all coefficients are assumed constant across firms within an industry.

Table 6 examines the relation between the unexpected components of inventory and receivables at the end of quarter t, and unexpected sales for quarter $t+1$, where expectations are conditional on sales for quarter t. We adopt the perspective of an investor who has received a sales announcement (along with an earnings announcement) for quarter t, but does not yet know the inventory and receivables balances for the end of quarter t. The investor has predicted sales for period $t+1$ using information about sales through quarter t with the time-series forecasting model developed by Foster [1977].[26] We then ask how much of the investor's sales forecast error could be explained by the unexpected changes in inventory and receivables balances reported for the end of quarter t.

Table 6 presents the regression equation used to assess whether inventory and receivables balances are incrementally useful in predicting sales. The results in panel A suggest that positive

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[26] This model assumes that quarterly sales follow a first-order autoregressive process in seasonal differences. See Table 5 for details.

TABLE 6

INCREMENTAL USEFULNESS OF INVENTORY AND RECEIVABLE BALANCES AS PREDICTORS OF FUTURE SALES, GIVEN THAT PRIOR SALES ARE ALREADY KNOWN

Explanation: Unexpected sales of quarter $t+1$ (where the expectation includes information about quarter t sales) are regressed against unexpected inventory and receivables balances of quarter t. The latter are intended to represent those portions of inventory and receivables that are not predictable, given that sales for quarter t are already known.

Pooled time-series, cross-sectional regression estimates for:

$$\frac{S_{t+1}-E(S_{t+1}|S_t)}{E(S_{t+1}|S_t)}=a_0+a_1\frac{I_t-E(I_t|S_t,I_{t-1})}{E(S_{t+1}|S_t)}+a_2\frac{R_t-E(R_t|S_t,R_{t-1})}{E(S_{t+1}|S_t)}+e_{jt-1},$$

where:

S_t = Sales for quarter t;
I_t = Inventory, end of quarter t;
R_t = Receivables, end of quarter t;
and expectations models are as described in Table 5.

Panel A. Full Sample of Individual Securities:

Independent Variable:	*Unexpected Inventory*	*Unexpected Receivables*
Coefficient	.24	−.19
t-statistic	6.55	−11.04

R-squared = .028 n = 5,585

Panel B. Sample of Individual Securities, Excluding "Outliers" (Observations excluded where absolute value of regressor exceeds 30 percent):

Independent Variable:	*Unexpected Inventory*	*Unexpected Receivables*
Coefficient	.18	−.01
t-statistic	4.70	−.23

R-squared = .004 n = 5,431

Panel C. Full Sample, Grouped into 25 Portfolios Based on Quintiles of UINV, *then on Quintiles of* UREC *within Each of the Original Quintiles*[a]:

Independent Variable:	*Unexpected Inventory*	*Unexpected Receivables*
Coefficient	.38	.08
t-statistic	5.51	1.50

R-squared = .601 n = 25

[a] No exclusion of outliers; when outliers excluded, results are similar.

sales forecast errors are associated with unexpectedly high prior-quarter inventory levels (t=6.55) and unexpectedly low prior-quarter receivables levels (t= −11.04).[27] Thus, revelation of the inventory and receivables balances could have served to improve the prediction of sales, even after prior sales had already been taken into account. However, in panel B, when outliers are excluded from the sample, the significance of receivables is lost.[28] Furthermore, the R^2s for the regressions in both panel A and panel B are extremely low (.028 and .004), indicating that improvements in sales forecasting ability are modest, even though statistically significant. In panel C, following an approach like that used in Beaver et al. [1979], firms are grouped into 25 portfolios based on rankings of their independent variables,[29] to determine the effect of diversifying some of the firm-specific "noise." After grouping, the R^2 rises (as expected) to .601 and unexpected inventory balances remain good predictions of future sales[30] (t=5.51); however, the coefficient on unexpected receivables switches sign.

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[27] There are more observations available in Table 6 than in Tables 1 and 2 because we need not restrict attention to firm-quarters for which detailed earnings compo-

On the basis of the evidence in Table 6 we conclude that there is modest support for the model. Specifically, inventory balances do appear to be incrementally useful in predicting future sales, after controlling for information about current and prior sales. Moreover, this supports the link in our model which differentiates its predictions from a simple "quality of earnings" story. But, receivables balances do not generally have similar predictive ability; so if unexpectedly high receivables balances are "bad news," the data do not support the existence of a link through future sales, as argued by O'glove [1987].

VI. TESTS OF THE INFORMATION IN EARNINGS COMPONENTS BASED ON THE LINKS BETWEEN INVENTORY, RECEIVABLES, AND FUTURE SALES

Since the model predicts that the security price implications of cash flows and accruals vary across firms, in addition to over time, it is possible that tests based on current accrual components could explain stock price behavior even when the tests previously discussed could not. Having established at least some support for the economic links between inventory, receivables, and future sales, we now seek to determine whether the current accrual components can explain stock price behavior around the release of quarterly and annual reports.

Our tests are based on a modified version of equation (6). Since Wilson [1986, sec. 5.2] presents evidence to show that noncurrent accruals are either uninformative, or already known prior to the financial statement release date, we drop $UNCA_{jt}$ as a regressor to obtain:

$$\begin{aligned} R_{jt} = b_0 &+ (b_{2I} - b_1)\,UINV_{jt} \\ &+ (b_{2R} - b_1)\,UREC_{jt} \\ &+ (b_{2P} - b_1)\,UPAY_{jt} + w_{jt}. \end{aligned} \tag{9}$$

The model discussed in Section V predicts that $(b_{2I}-b_1)$ is positive, and that $(b_{2R}-b_1)$ is negative. Our model suggests that unexpected payables convey (in a noisier fashion) the same information conveyed by unexpected inventory. Thus, given that $UINV_{jt}$ is already included in the regression, the model provides no motivation for including $UPAY_{jt}$. However, since the portion of unexpected payables that is not redundant with unexpected inventory could

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nent data are available for the first time upon release of the financial statements, and because missing CRSP data is not an issue here.

[28] Observations where the absolute value of *UINV* and *UREC* exceeded 30 percent of sales were classified as outliers. A casual examination of the data indicates that some of these outliers are caused by events such as acquisitions and the initial offering of credit cards to customers.

[29] First, we rank all observations (firm-quarters) on unexpected inventory and form five groups. Then, within each of those groups, we rank firm-quarters on unexpected receivables, and again form five groups.

[30] This result is qualitatively insensitive to the exclusion of outliers.

conceivably have security price implications, we present estimates of equation (9) both with and without $UPAY_{jt}$. The expectations for payables are conditioned, in part, on the contemporaneous values of inventory and receivables, so that any information reflected in $UPAY_{jt}$ is intended to be incremental to that in $UINV_{jt}$ and $UREC_{jt}$ (see Table 5 for details).

There are two procedural differences between the tests summarized here and those used in the replication and extension of Wilson [1987]. First, for the vast majority of fourth quarter observations where both the 10-K and annual report date are available, we use the *earlier* of the two, rather than just the annual report date.[31] Second, whereas our earlier tests used market model prediction errors to maintain comparability with Wilson, here we report results based on market-adjusted returns.[32] However, our results are qualitatively insensitive to both of these procedural differences, with one exception, as discussed below.

Estimates of equation (9) appear in Table 7. Panel A presents results of estimating equation (9) while using only the two regressors (*UINV* and *UREC*) for which the model offers predictions. Panel B presents estimates of the full equation, including *UINV*, *UREC*, and *UPAY*. The estimates in panel A provide little support for the predictions of our model: the coefficients on unexpected inventories all take on the predicted positive sign, but none is significant, and coefficients on unexpected receivables are generally of the wrong sign and insignificant. Overall, the explanatory power of these regressions is quite low; the R^2 is never higher than .02.

In panel B, we again find no support for predictions concerning *UINV* and *UREC*.[33] In contrast, *UPAY* does take on significant coefficients using data from only fourth quarters. However, it is not clear why unexpectedly high payables balances should reveal favorable information about the value of the firm, after controlling for the level of inventory.[34] Also, although the result (and all others in Table 7) is insensitive to the treatment of outliers,[35] all t-statistics are below 1.7 when market model prediction errors are substituted for market-adjusted returns, or when Wilson's approach and only annual report dates are used. Finally, the result is insignificant at the .10 level in the full sample.

Our final attempt to find support for the model involved focusing on a subset of the sample industries. We identified ten of 33 industries where unexpected inventory balances provided statistically significant incremental explanatory power (at the .01 level, using a one-tailed

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[31] Because we also use 10-K dates in cases where no annual report date is available, there is a slight increase in sample size.

[32] That is, we simply subtract the market index return from raw returns since we were concerned that "noise" in the market model intercepts from short (90-day) estimation periods used in our replication of Wilson [1987] would offset any advantages of using the market model. Brown and Warner [1985] indicate there is no clear gain in power from using market model prediction errors instead of market-adjusted returns even though their market model is estimated with 250 observations. Others share this concern (see Penman [1988], esp. note 3).

[33] Some may wonder why inclusion of *UPAY* affects the estimates of coefficients on the other regressors, given that *UPAY* is designed to capture only information incremental to inventory and receivables. One reason is that since expectations for the three regressors are created in time-series, industry-by-industry, they would not necessarily be orthogonal in the final, pooled cross-sectional regression. The second reason is that the expectations for payables are conditioned on contemporaneous levels of inventory and receivables, not on *UINV* and *UREC per se*.

[34] One possibility is that unexpectedly high payables arise when the firm builds raw materials inventory near the end of the quarter. If that action is taken in anticipation of higher demand, it could be viewed as a good signal by the market.

[35] As in Table 7, outliers are defined as observations where at least one of the regressors (prior to scaling) has an absolute value greater than 30 percent of sales.

TABLE 7

REGRESSIONS OF MARKET-ADJUSTED STOCK RETURNS DURING THE FINANCIAL STATEMENT RELEASE PERIOD AGAINST UNEXPECTED INVENTORY, RECEIVABLES, AND PAYABLES, CONTROLLING FOR CONTEMPORANEOUS SALES AND EARNINGS (1977–1984)

Pooled time-series cross-sectional regression estimates for equation (9):

$$R_{jt}=b_0+(b_{2I}-b_1)UINV_{jt}+(b_{2R}-b_1)UREC_{jt}+(b_{2P}-b_1)UPAY_{jt}+e_{jt},$$

where:

R_{jt}=Market-adjusted return for firm j, during nine days surrounding release of financial statements for quarter t;
$UINV_{jt}$=unexpected inventory at end of same quarter;
$UREC_{jt}$=unexpected receivables at end of same quarter; and
$UPAY_{jt}$=unexpected payables at end of same quarter.

(Expectations for all independent variables are conditioned on quarter t sales and earnings and all regressors are scaled by market value of equity prior to the event window.)

Panel A. Estimation Excluding UPAY *as Regressor:*

Sample	*Coefficients* (*t-statistics*) $b_{2I}-b_1$	$b_{2R}-b_1$	$b_{2P}-b_1$	R^2	n
All firm quarters	.01 (.38)	−0.1 (−.43)	—	.000	2,589
Fourth quarters only	.03 (1.25)	.01 (.37)	—	.002	858
Fourth quarters, 1981–1982	.06 (1.34)	.09 (1.64)	—	.020	206

Panel B. Estimation of Full Model:

Sample	*Coefficients* (*t-statistics*) $b_{2I}-b_1$	$b_{2R}-b_1$	$b_{2P}-b_1$	R^2	n
All firm quarters	−.00 (−.13)	−.01 (−.64)	.02 (1.52)	.001	2,589
Fourth quarters only	.01 (.41)	−.00 (−.15)	.06 (2.58)	.010	858
Fourth quarters, 1981–1982	.03 (.62)	.05 (.94)	.10 (2.53)	.051	206

test) in the sales prediction equation of Table 6. We then reestimated regressions like those summarized in Table 7. Again, the estimated coefficients were not reliably different from zero.

We conclude that there is little support for the stock price predictions derived from consideration of the separate effects of the components of unexpected current accruals. As in previous sections, we are unable to explain stock price behavior around the release of financial statements by using detailed information about cash flows and accruals.

VII. CONCLUDING REMARKS

This paper has reexamined recent research concerning the valuation implications of detailed components of earnings (in particular, cash flows and current accruals) and has attempted to develop some economic logic for why the valuation implications should differ across these components.

Our approach was to attempt to confirm one simple relation observed in prior research, and then to examine progressively more contextual models of the valuation implications of cash flows and accruals. We were unable to confirm that the relation observed by Wilson [1986 and 1987]—a larger price reaction to cash flows than to accruals—extends beyond his test period of the fourth quarters of 1981 and 1982. When we allowed the relative impacts of cash flows and accruals to vary according to the state of the economy, we were again unable to explain a significant fraction of stock price behavior. Moreover, our failure to find evidence of any significant variation over time in the relative impacts of cash flows and accruals suggests that other partitions of the data according to time periods are not likely to overturn this conclusion. Finally, we introduced a model in which the relative price impacts of cash flows and accruals depend on what the accruals reveal about management expectations of future sales. Although we found modest support for the economic logic underlying the model, we were unable to detect any empirical support for its stock price predictions.

Whenever one fails to reject the null hypothesis in research of this nature, there are several potential explanations. We have conducted a number of supplemental analyses in an effort to eliminate some of these explanations. We believe the remaining explanations fall into two categories. One maintains that financial statement release dates may not represent important events for pricing, because the essential information included therein has already been made available through alternative channels. This explanation is consistent with our previous interpretation of Bowen et al. [1987], whose results imply that cash flows and current accruals have different associations with returns measured over annual intervals. However, Rayburn [1986] finds no such difference, and even in Bowen et al., the result is sensitive to treatment of outliers, and is significant in only two of ten years (see Bowen et al. [1987, table 7, pgs. 744–745], in conjunction with our discussion in Section I). A second explanation maintains that differences in the valuation implications of cash flows and the various accrual accounts are more contextual than any of the models examined here.

Our conclusion is that further progress in this line of research will require a better understanding of the economic context in which the implications of detailed earnings components are interpreted. In addition, any research based on short-run association tests will require more knowledge of the process by which information is transmitted from firms to the public. In the meantime, we suggest that it is possible that the links between detailed earnings components and valuation are so highly contextual that no parsimonious model could ever capture more than a small portion of the story.

APPENDIX

A SIMPLE MODEL OF THE LINKS BETWEEN CURRENT ACCRUALS AND FUTURE SALES

We consider a model of the operating cycle of the firm, in order to identify what valuation-relevant signals might be conveyed by information about current accruals. Two of the three major components of current accruals are considered: changes in inventory and changes in receivables.

Changes in Inventory Balances

Assume that inventory at the end of period t, denoted by I_t, consists of two components. The first is I_t^*, representing the optimal balance of inventory, given management's expectation of future sales $E_t(S_{t+1})$. The second component is D_t, representing the deviation from the optimal balance. This component depends on not only the deviation of period t sales (S_t) from management's expectations at the end of period $t-1$ ($E_{t-1}(S_t)$), but also on the previously existing deviation from the optimal balance (D_{t-1}). Thus:

$$I_t = I_t^* + D_t, \tag{A1}$$

where (by assumption):

$$I_t^* = k_{1q} E_t(S_{t+1}), \tag{A2}$$

and:

$$D_t = k_2 D_{t-1} + k_3 [E_{t-1}(S_t) - S_t]. \tag{A3}$$

The behavioral assumption underlying equation (A2) is that the optimal inventory balance is a constant fraction of management's expectation of next quarters' sales, where this fraction may vary only with the quarter (q) of the firm's fiscal year.[1] Equation (A3) assumes that, if actual sales levels differ from expectations, then an unplanned inventory buildup or liquidation, in the amount $k_3[E_{t-1}(S_t) - S_t]$, would occur by the end of period t. In addition, equation (A3) posits that if a deviation from the optimum (D_{t-1}) already existed at the beginning of the period, a fraction k_2 of that deviation would still remain at the end of the period.

Noting that $D_{t-1} = I_{t-1} - I_{t-1}{}^* = I_{t-1} - k_{1q} E_{t-1}(S_t)$, we can combine equations (A1), (A2), and (A3) to obtain:

$$I_t = k_{1q} E_t(S_{t+1}) + k_2 I_{t-1} - k_2 k_{1q} E_{t-1}(S_t) + k_3 [E_{t-1}(S_t) - S_t]. \tag{A4}$$

After earnings and sales have been announced, but before the inventory balance is revealed in the published financial statements, the market is already aware of how large an "inventory buildup" or "inventory decline" should have occurred as a result of sales deviating from expectations. Those effects are captured in the last three terms in equation (A4). What the market does not know (with certainty) is the first term, which depends on management's expectation of future sales, $E_t(S_{t+1})$. Publication of the inventory balance in the complete financial statements permits the market to infer what management expectations must be.

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[1] We recognize that more sophisticated models of optimal inventory balances exist. Our simple specification in equation (A2) is motivated primarily by a desire for parsimony and to specify the model in terms of observable variables.

The empirical tests require an estimate of expected inventory from the point of view of the market, after the announcement of sales but before the release of financial statements. For that purpose, we use the sales forecast model in Foster [1977] to proxy for the market's expectation of future sales, and estimate the following analog of equation (A4):[2]

$$I_t=m_1k_{1q}E_t(S_{t+1})+m_2I_{t-1}-m_3k_{1q}E_{t-1}(S_t)+m_4[E_{t-1}(S_t)-S_t]+e_t, \qquad \text{(A5)}$$

where:

k_{1q}=seasonal adjustment factor, equal to the mean inventory-to-expected-sales ratio for each firm and each of the four quarters of the fiscal year; and

m_1, m_2, m_3, m_4=coefficients to be estimated, assumed identical within industries, but permitted to vary across industries.

In estimation, all left-hand and right-hand side variables are scaled by sales, to permit pooling across firms within the same industry.

Changes in Receivables Balances

Letting R_t, S_t, and C_t denote receivables at the end of period t (net of allowances for bad debts), sales for period t, and collections for period t, respectively, we have the accounting identity for receivables:

$$R_t=R_{t-1}+S_t-C_t. \qquad \text{(A6)}$$

We model collections as a function of the beginning balance of receivables, the current period's sales, and a disturbance term, u_t:

$$C_t=p_1R_{t-1}+p_2p_{3q}S_t+u_t. \qquad \text{(A7)}$$

The term $p_2p_{3q}S_t$ captures the portion of current sales that are expected to be collected within the same period, in accordance with management's long-run credit policy (the term p_{3q} is permitted to be seasonal, as in the inventory model). The term u_t captures transitory deviations from expected collections, due to changes in credit policy, or customers' willingness or ability to pay. Combining equations (A6) and (A7) yields:

$$R_t=(1-p_1)R_{t-1}+(1-p_2p_{3q})S_t-u_t. \qquad \text{(A8)}$$

After sales (S_t) are announced, but before the end-of-period receivables balance (R_t) is revealed, the market already knows the first two terms on the right-hand side of equation (A8). Revelation of R_t permits the market to infer u_t, the deviation from the expected collection experience.

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[2] While k_2 appears twice in equation (A4), we do not impose this restriction in estimation. The reason for this is to let the parameters on I_{t-1} and $k_{1q}E_t(S_{t-1})$ remain free to help eliminate sources of nonstationarity not identified in the derivation of the model. This is equivalent to permitting the error term to be a function of those terms. Also note that permitting the coefficients in equation (A5) to vary across industries can mitigate potential problems arising from the use of different inventory costing methods, such as LIFO and FIFO.

The empirical tests require an expectation of R_t from the market's perspective. Our expectation model is based on an estimate of equation (A8). In estimation, we assume that p_{3q} is equal to the mean collections-to-sales ratio for each firm and each of the four quarters of the fiscal year. We also assume that p_1 and p_2 are identical within industries, but permit them to vary across industries. To permit pooling within industries, we scale all variables by sales.

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Auditors' Confidence in Recognition of Audit Evidence

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ABSTRACT: Auditors' reliance on their memories vis-à-vis their reliance on external information sources such as workpapers is of practical as well as research interest. This study examined auditors' relative confidence in relying on accurate and inaccurate recognitions of audit evidence. Each of 85 practicing auditors was asked to review a set of hypothetical audit workpapers, then after one day's delay, to respond to a recognition test and rate their confidence in their recognitions. They were asked to use the confidence rating to reflect their willingness to rely on their recognitions rather than on reviewing the workpapers or source documents again. Auditors were most confident in two cases: when they accurately recognized evidence that they had previously seen and when they confused their own inferences with actually observed evidence. Auditors are often as confident in their incomplete and inaccurate recognitions as they are in their accurate recognitions.

AUDITORS evaluate large quantities of information in order to comply with the audit standard of obtaining "sufficient competent evidential matter" [AICPA, 1986]. The volume of audit work and the hierarchical structure of audit teams have implications for the role of auditors' memories in the opinion formulation process. Specifically, as auditors proceed through an audit, previously encountered, original source evidence is not often readily available. Therefore, auditors must initially refer to their memories in order to assess the implications of current evidence. The key to whether auditors rely exclusively on their memory for audit evidence or verify recollections by referring to workpapers is their confidence in their memory of the original observation.

Recent research (e.g., Moeckel [1988]) indicates there are cases of auditors' memory failure where retrievals from memory do not accurately represent previously encountered information as it was actually observed. These failures occur in spite of auditors' attempts to mitigate their possible effects by using decision aids, and setting documentation and workpaper review standards. One reason why such memory failures could go undetected is that auditors may place too much confidence in the accuracy and

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completeness of their memories. Potentially serious problems arise if auditors place confidence in inaccurate memories and then use those unsupported inferences or inaccurate memories of details as inputs to audit judgments. An auditor who is confident that the memory of the preceding evidence is accurate, and thus would be supported by the workpapers, will evaluate current evidence based on the memory of the previous evidence. Reference to the workpapers or source documents, which requires an overt act by the auditor, will be undertaken only if the auditor lacks confidence in the recollections. Unless some subsequent event leads to a lack of confidence in the information retrieved from memory and thereby triggers a reconsideration of the available evidence (from both the workpapers and memory), the auditor could reach faulty conclusions about the results of audit tests. In addition, the auditor may ignore evidence that may make a material difference in deriving new hypotheses about audit evidence [Libby, 1985].

This paper reports a study that compares the degree of confidence with which auditors might rely on accurate recognition of audit evidence to the degree of confidence with which they might rely on inaccurate recognition of audit evidence. The results show that in general auditors are at least as confident and sometimes more confident of inaccurate memories as accurate memories.

The next section of this paper develops the hypothesis about auditors' confidence in their memories. The second section describes the experiment used to test the hypothesis, and the third section presents the results. In the fourth section, the conclusions and their implications are discussed.

I. PRIOR RESEARCH AND A HYPOTHESIS

Background

Our hypothesis is based on a simple model of cognitive information processing which consists of three components: sensory stores, short-term memory (STM), and long-term memory (LTM) [Bettman, 1979]. The focus is on STM and LTM which represent the currently activated portion of memory and the entire memory itself, respectively, and which have distinct functions in the processing of information.[1] LTM is "a permanent and essentially unlimited store" [Bettman, p. 151] in which semantic concepts and associations between those concepts are stored. The role of STM in this model is to temporarily store information that is currently being used in some cognitive task (e.g., problem solving), or new information to be transferred to LTM.

There are two important processes that affect the flow of information between STM and LTM: encoding and retrieval. Encoding is the process of forming the associations between any new information and existing information which are necessary to store the new information in LTM. Retrieval occurs when a piece of information is reactivated subsequent to encoding and storage in LTM.[2]

There are two general types of retrieval: recognition and recall. Recognition occurs when a match is detected between an externally supplied piece of information and information retrieved from LTM. Recognition is not considered to be affected by a retrieval strategy, since individuals have an externally generated cue that they check for a match with information from LTM. On the other hand, recall does not provide the benefit of an externally generated target cue with which the to-be-retrieved information can be *directly* compared and matched.[3] Even though recognition and recall presumably rely on activating the same memory traces, recall performance is subject to problems with retrieval processes and memory organization, in addition to any failures during the matching process [Lynch and Srull, 1982]. Thus, even though auditors would most often need to recall previously examined information when evaluating subsequent evidence, a recognition test is used here in order to probe the contents of subjects' memories most directly, without the confounding by retrieval strategies that would occur using a recall test. Certainly, any failures due to retrieval strategy would also qualify as memory errors, but of a different type than those focused on here.

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[1] While sensory stores are important in the cognitive processing of information, they represent memories that decay in milliseconds, and are of more interest to cognitive psychologists than to accounting researchers.

[2] Among the factors that influence the ability to retrieve of a piece of information are the amount of elaboration that occurred at encoding [Craik and Tulving, 1975; Anderson and Reder, 1979], and number of related concepts stored in LTM [Craik and Tulving, 1975].

Levels of Confidence in Memories for Audit Evidence

An auditor's confidence in using what is retrieved from memory reflects a belief in the accuracy of the compatibility (match) between the implications of information retrieved from LTM and current evidence. In cases where an auditor is confident that the information has been correctly retrieved, searching for information in LTM or external sources (e.g., workpapers) ceases. On the other hand, if the auditor is not confident that the information retrieved is an accurate representation of prior observations, he or she may continue to search LTM, or seek the information from workpapers or source documents. Thus, it is the auditor's *confidence* in the match between information retrieved from LTM and current evidence that determines whether the recollection will be verified by reference to an external source.

Few of the studies reported by either psychologists or accounting researchers have examined the degree of confidence with which subjects rely on their memories. Most research into individuals' confidence has focused on aspects of judgment, such as self-assessed expertise [Einhorn and Hogarth, 1978] and calibration of probability assessments (e.g., Lichtenstein et al. [1982]), rather than directly on subjects' confidence in their cognitive abilities. The general finding of this research is that persons are overconfident in their abilities to judge. Einhorn and Hogarth [1978] suggest that this overconfidence may be the result of a learning environment where outcome feedback is incomplete and judgments are self-fulfilling prophecies. Waller and Felix [1987] conducted a laboratory study which provides evidence that auditors may be overconfident in their decision to rely on internal controls. They find that this overconfidence may be a function of the type of outcome feedback that auditors receive.

Confidence was also examined in a

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[3] Recall and recognition may both be viewed as being "cued" since something triggers the memory search. In the case of recognition, the cue and the information stored in memory which the individual searches to match are the same. On the other hand, recall involves either a related but not identical cue which is cued recall, or a cue which the individual generates internally, known experimentally as "free recall."

series of studies that focused on a phenomenon called the "illusion of knowing," which is the joint occurrence of overconfidence in comprehension of text and either failure to detect a contradiction [Epstein et al., 1984; Glenberg et al., 1982] or failure to properly verify an inference [Glenberg and Epstein, 1985]. These studies did not require the subjects to recall or recognize. Instead the researchers compared subjects' ratings of confidence in comprehension with either the rates of detection of a contradiction in text or the accuracy of inference verification. Glenberg and Epstein [1985] describe the relation between properly verifying an inference and confidence ratings as the "calibration of confidence." Confidence is well-calibrated when accuracy in a verification task has a direct, positive relation with confidence. That is, a person is well-calibrated when he or she is very confident of accurate beliefs and lacks confidence in inaccurate beliefs. The results indicate that persons responding to either general or very specific questions about their understanding of the text were consistently overconfident and, therefore, miscalibrated.

The work that most directly assessed confidence in memories was Spiro [1980], who had subjects provide an explicit confidence rating. Spiro's main research interest was an examination of the conditions under which particular types of memory errors would be made. His subjects were asked to recall from text and then rate their own recollections as to how confident they were that the remembered item was explicitly stated in the material they had previously read. Subjects who were in experimental conditions causing them to be more prone to memory errors (conditions that involved either producing the recall protocols after longer delays or processing the original material for meaning rather than memorizing) displayed greater confidence in their erroneous memories than in their accurate memories.

Auditors involved in all but the simplest tasks must process audit evidence for meaning over extended periods of time, and may tend to exhibit similar patterns of confidence in their memories. For example, experienced auditors have stored in their memories the concept of "sales/receivables internal control system." If, when reviewing such a system, an auditor finds that customers were *not* billed for backordered items, that auditor may infer, based on the knowledge stored in LTM, that adequate controls over backordered goods exist whether or not explicit observations of those controls were made. If the auditor infers that adequate controls over backordered items exist and upon retrieval of the inference from memory fails to verify what was actually seen due to overconfidence in the accuracy of the information retrieved, a memory error has occurred and gone undetected. Memory errors such as this have implications for the quality of the audit judgments about the internal control system.

The implication of the research described above is that auditors may be overconfident in their ability to recognize audit evidence. Viewed in terms of calibration of confidence, overconfidence would exist when auditors had equal or greater confidence in the recognition of inferences compared to their confidence in accurately recognized items. Thus, we formulated the following hypothesis.

Hypothesis: Auditors will be at least as confident of their inaccurate memories as of their accurate memories.

II. RESEARCH METHOD

Materials and Procedure

Each of 85 auditors from a Big Eight

CPA firm completed an experiment in two phases which were performed approximately 24 hours apart.[4] During Phase I, the subjects simulated a supervisor's review of a subset of hypothetical audit workpapers including the trial balance and selected workpapers which documented evidence gathered as part of the inventory observation for a small manufacturing company. The experimental materials were pretested through three rounds of reviews by auditors from the subject firm. The pretest was to ensure that the documentation style and tone were in accordance with what the experimental subjects would be used to seeing, and that there were no errors other than eight instances of intentional contradictions which were dispersed throughout the workpapers. Each instance of contradictory evidence was made up of two subsets. One subset was intentionally vague, but reasonably led to a particular implication or inference; the other subset contradicted the implication. In each of the eight sets, the contradicted and contradicting subsets of information were explicit in the workpapers. The inference that could be drawn from the contradicted subset of evidence was *not* included anywhere in the workpapers (all sets are on Table 1, discussed below).

The instructions emphasized that the participants were performing the only supervisor's review of the work of an assistant who was making normal progress with the firm. The participants were instructed to concentrate on writing review notes that would (1) improve the assistant's audit skills, and (2) ready the workpapers for final filing in support of an audit opinion. The materiality scope was purposely set quite low ($1,000 on assets of $738,130) in order to ensure that the subjects did not simply dismiss any of the manipulated items as being immaterial. It was also stressed that any problems detected with the audit work or documentation should be listed for follow-up. The instructions read,

> You should write review points for *any* issue you think [needs to be addressed or clarified further]. If you think an item has *any potential* to cause a problem with the audit, or indicates that [the preparer] has not fully understood the audit evidence, please record a review point.

Thus, subjects were encouraged to make careful, detailed reviews, and their learning should have been reinforced by writing review notes. In addition, subjects were told that,

> Tomorrow you will be asked to make some further judgments about the workpapers you are reviewing today. These judgments are designed to be similar to judgments you make as you are wrapping up work on any audit, and will require you to consider the information you are about to review in much the same way as you would give continuing consideration to what you learn about any actual client.

This instruction was added to ensure that the subjects would make an effort to process the audit evidence sufficiently well to perform as they usually would when called upon to remember evidence some time after they encountered it.

During Phase II, subjects were given a recognition test based on the original evi-

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[4] Twenty-nine subjects at firmwide training schools completed Phases I and II after lunch on succeeding days; 22 subjects completed Phase I before lunch and Phase II at 8:00 a.m. the following day; 25 completed Phase I before lunch and Phase II after lunch on succeeding days. Nine participants completed Phase II at their desks in their home offices and mailed their responses. They were asked to wait at least four but no more than 24 hours between phases. In order to test whether these nine subjects differed systematically from the others in confidence ratings across the nine possible combinations of the two independent variables discussed below, we used "delay" as an indicator variable to segregate those who completed Phase II in their offices from the rest. There was no significant difference ($F_{8,1970}=1.02, p=0.4212$).

TABLE 1

RECOGNITION TEST ITEMS ORGANIZED BY ITEM TYPE

ITEM TYPE	*Recognition Test Statement as Subjects Saw It*
EXPLICIT	1. The scope for posting audit differences to the audit differences summary page is $1,000 for both balance sheet and income statement accounts.
EXPLICIT	2. Philips Co. made its entry into the market for water purification systems nearly eight years ago when it introduced a design for a compact roto reverser system.
EXPLICIT	5. Philips Co. likes to think of itself as a family, and has had the same core of 22 employees at its Stillwater and Coldton plants for the last seven years.
EXPLICIT	8. There were strong markets at the end of the prior year. Philips had forecast the strong markets would bear both price and volume increases.
EXPLICIT	11. The costs of key components of roto reversers [Philips' major product line] increased across the board.
EXPLICIT	13. A review of the comparative figures showed the office salaries expense balance decreased less than $1,000 from 1985 to 1986.
EXPLICIT	20. The inventory counts were done by teams of production and design personnel, who are familiar with the components and systems in inventory and production.
EXPLICIT	23. I toured the entire warehouse at the end of the count and made sure that the count teams had not missed any inventory by noting the second copy of count tags attached to all items or bins.
NEW	3. The company closed all its branches in order to save inventory carrying charges.
NEW	7. Stock with par value of $10,000 was issued to employees in lieu of salary increases.
NEW	10. Interest expense decreased 5.5 percent due to general declines in market rates.
NEW	14. The NSF check from Ramp Co. indicated uncollectability of the account receivable.
NEW	15. There is adequate segregation of duties in the overall design and operation of the internal control system.
NEW	16. The results of the compliance test in the shipping department showed that controls are operating as designed.
NEW	18. The client's offices are located on the third floor above its warehouse.
NEW	21. The company incurred new debt in order to build up inventory.

dence contained in the workpapers and asked to rate their confidence for each of their responses to the recognition test. Confidence was rated on a nine-point scale, anchored on "uncertain" and "certain." Subjects were asked to make their confidence ratings reflect "how willing [they] would be to rely on [their memories] rather than referring back to the audit evidence or audit workpapers"

TABLE 1—*Continued*

<table>
<tr><th>Contradicted</th><th>Contradicting</th></tr>
<tr><td>Philips had early success in 1980 with a large five-year contract with the U.S. Department of Health and Human Services on its major product line. . . . Companies in the highly competitive and speculative arena in which Philips operates require a marketing or production edge to reduce their exposure to inherent risk.</td><td>[It is September 5, 1986 and work is about to wrap up on the 8/31/86 audit. Therefore, the contract already has or must be about to expire.</td></tr>
<tr><td colspan="2">INFERENCE[1] 4. Because it has a large U.S. government contract on its major product line, Philips Co. has protection from inherent risk.</td></tr>
<tr><td>The company will probably make about a 20 percent return on its remaining parcel of land since the federal government is considering making it into a park and has paid top dollar in the past in such circumstances. . . . I told the controller that according to GAAP an investment that has appreciated should be stated at cost, since gains may not be booked before being realized.</td><td>The EPA has just confirmed that a toxic waste dump on the parcel of land Philips Co. sold has leaked PCBs into the ground water. That land has been rendered uninhabitable.</td></tr>
<tr><td colspan="2">INFERENCE 6. The parcel of investment land Philips Co. still holds in California should be stated at cost, since gains may not be booked before being realized.</td></tr>
<tr><td>There were strong markets at the end of the prior year. Philips had forecast the strong markets would bear both price and volume increases. To get in on the price increases it had predicted would result from the stronger market at the end of FY 1985, Philips changed its pricing policies across the board in both March and June.</td><td>Philips decreased its prices across the board in both March and June in order to reduce its inventory buildup.</td></tr>
<tr><td colspan="2">INFERENCE 9. Philips increased its prices across the board in both March and June in order to get in on the price increases it had predicted would result from the stronger market at the end of FY 1985.</td></tr>
<tr><td>The decreases in SG&A in 1986 were the result of the closing of the Sunnyvale plant. The closing of the Sunnyvale plant led to Philips' saving the salary of one full-time office clerk.</td><td>[Subjects saw the following account analysis.]
1986 1985
Sales commissions 62,607 57,173
Office salaries 25,391 25,842
Other G&A 33,742 33,025</td></tr>
<tr><td colspan="2">INFERENCE 12. The decreases in SG&A were due to saving the salary of one full-time office clerk in Sunnyvale (where the plant was closed).</td></tr>
<tr><td>[Statements were made in the client profile that all invoices go to the Stillwater plant; and that inventory costs are higher at the Coldton plant.]</td><td>[Subjects examined invoices, some of which were for goods shipped to the Coldton plant.]</td></tr>
<tr><td colspan="2">INFERENCE 17. Invoices used in the price test of inventories at Stillwater were invoices for goods shipped to the Stillwater plant.</td></tr>
</table>

for confirmation of the accuracy of their memories. The instructions went on to say, "If you are certain about what you did or did not observe, or inferred, and would be willing to base further audit work on what you remember having seen, you should rate a high degree of certainty."

Design

Two independent variables, whose interaction defined accuracy, were used when exploring auditors' confidence in their recollections. One independent variable, RESPONSE, was the code assigned by each subject to each of the

TABLE 1—*Continued*

Contradicted	*Contradicting*
The program called for using a job with design charges in addition to components and labor charges. . . . There were no jobs in the warehouse that included design charges.	These two projects included charges for a design that was common to both so each job has low charges for a design that is 95 percent complete. Philips split the design charges incurred between the projects, since the design work applied to the jobs equally.
INFERENCE 19. Since there were not jobs in the warehouse that included design charges, a change in the audit plan was approved.	
The plant was scheduled to be closed on the day of the inventory count in order to facilitate an accurate count. . . . There were no movements from raw materials to WIP or from WIP to finished goods.	[Subjects saw two workpapers that showed the Ryland system in WIP about 95 percent complete, then in FG 100 percent complete.] The Ryland system had the same job number in both places, was highlighted on the WIP schedule because the subjects should have checked the dollar amount on it to see that the scope was correctly applied for the testing on WIP, and was highlighted on FG because of a tag mix-up.
INFERENCE 22. Since the plant was not operating on the day of the inventory count, there were no movements from raw materials to WIP or from WIP to finished goods.	
The $10,000 T Note is an asset that can be readily converted to cash. Such assets should properly be classified as cash equivalents.	See Schedule A-1, assets, for examination of the $10,000 T Note that is pledged as collateral on this note.
INFERENCE 24. Since the $10,000 T Note is an asset that would properly be classified as cash equivalent, it should be reclassified out of "other assets."	

Note: For INFERENCE items, the numbered entry in the table is the test item that could reasonably have been inferred from the contradicted evidence. The contradicted and contradicting evidence were in the workpapers but the INFERENCE test item itself was not provided to subjects until the recognition test. Numbers of items show where they were on the recognition test.

recognition test items. Subjects coded whether they thought each item had been "explicit" in the original, a "valid summary" of all the evidence in the original, or "new, not a valid summary." The "explicit" code was included to permit subjects to reveal a judgment that an item had been seen in exactly that form earlier and that it represented an exact match for their memory of the evidence. The "valid summary" code was included so subjects could indicate the existence of memories of the evidence that were in substantial agreement with the test item without being pressed to quibble about exact wording.

The second independent variable, ITEM TYPE, was the type of recognition test item presented to the subjects. Table 1 presents the 24 recognition test items, grouped by ITEM TYPE. Of the 24 items on the test, eight were quoted from the workpapers that subjects had reviewed in Phase I (EXPLICIT) and eight were items not mentioned in the workpapers (NEW). Another eight were inferences that could be drawn from the contradicted subsets in the workpapers (INFERENCE). Using three ITEM TYPES instead of two (EXPLICIT and NEW), as is typically done in recognition tests, allows for closer inspection of the nature of auditors' errors by allowing for different types of possible errors with different practical consequences. That is, the practical consequences of auditors indicating that an item they had never seen (NEW items) was "explicit" are not

TABLE 2

MEMORY ERROR CONDITIONS THAT RESULT FROM THE COMBINATION OF THE TWO INDEPENDENT VARIABLES: RESPONSE (THE SUBJECT'S RESPONSES) AND ITEM TYPE (EACH TYPE OF STIMULUS ITEM ON THE RECOGNITION TEST)

		ITEM TYPE		
		EXPLICIT *Quote from the Phase I Materials*	*NEW* *Not Present in the Phase I Materials*	*INFERENCE* *Inferable, but Contradicted in the Phase I Materials*
RESPONSE	"Explicit"	NO Memory Error 7.34[1] (n=381)[2]	Memory Error 5.94 (n=51)	Memory Error 7.59 (n=259)
	"Valid Summary"	Memory Error 5.80 (n=120)	Memory Error 5.09 (n=81)	Memory Error 6.27 (n=153)
	"New, Not a Valid Summary"	Memory Error 4.60 (n=167)	NO Memory Error 5.36 (n=531)	NO Memory Error 5.71 (n=245)

[1] For each combination, the mean confidence rating and number of occurrences are shown below the error condition.

[2] Of the total 2,040 possible responses, 22 were not classifiable into any of these categories because subjects gave some other type of response, and 30 involved either no confidence rating, or no "explicit," "new," or "summary" coding given. One subject gave no response codings.

as serious as their indicating that an item that was expressly contradicted in the materials (INFERENCE items) was "explicit."

Crossing ITEM TYPE and RESPONSE produces nine variants, six of which represent inaccurate responses and three of which represent accurate responses. Each of the eight EXPLICIT and eight NEW items would have been correctly coded by sujects as "explicit" or "new," respectively. Such codings would result in "no error" being identified; other codings on these items would be examples of memory "error." The eight INFERENCE items would have been coded correctly by the subject as "new, not a valid summary." None of the eight INFERENCE items was explicitly in the original, and each was contradicted so none was a "valid summary" of all the evidence reviewed.[5] Table 2 shows the possible combinations of ITEM TYPE and RESPONSE, and which of the two

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[5] Moeckel [1987] discusses some possible determinants of auditors' inability to detect the contradictions. Subjects were asked to note any workpapers that they did not review to their own satisfaction, and responses of subjects who listed any workpaper as not satisfactorily review were discarded. Under these conditions, failure to perceive a contradiction must result from some sort of memory encoding error or retrieval failure, so all such items are properly classified as memory errors.

TABLE 3

PAIR-WISE COMPARISONS BETWEEN THE MEAN CONFIDENCE RATINGS FOR COMBINATIONS OF RESPONSE AND ITEM TYPE THAT WERE *NOT* MEMORY ERRORS AND THOSE THAT WERE MEMORY ERRORS

	MEMORY ERRORS					
	EXPLICIT Items Coded as:		*NEW Items Coded as:*		*INFERENCE Items Coded as:*	
ACCURATE MEMORIES	*"Valid Summary"*	*"New"*	*"Explicit"*	*"Valid Summary"*	*"Explicit"*	*"Valid Summary"*
EXPLICIT items coded as explicit	F*	F*	F*	F*	S	F*
NEW items coded as new	S	S	S	S	S*	S
INFERENCE items coded as new	S	F*	S	S	S*	S

S = Test supports the hypothesis; the confidence rating for a memory error is greater than or equal to the rating for an accurate memory.

F = Test fails to support the hypothesis; confidence rating for a memory error is less than the rating for an accurate memory.

* Significantly different for one-tailed *t*-tests with an alpha level of .05 or less, using the Scheffe method of controlling the experiment-wise alpha level.

memory error conditions results from crossing these two factors.

III. DATA ANALYSIS

The dependent measure was the subject's confidence rating for each code assigned to the 24 items on the recognition test. The initial analysis was an unbalanced ANOVA with ITEM TYPE, RESPONSE, and their interaction as factors.[6] This overall test indicated that all three factors were significant ($p \leq .001$).[7] The mean confidence ratings and the number of occurrences for each combination are shown in Table 2.

In order to directly examine the relation between accuracy and confidence, we made pair-wise comparisons between the mean confidence ratings for the three combinations of RESPONSE and ITEM TYPE that were not memory errors and the six combinations that were memory errors (see Table 3). Generally, the results of these tests support the hypothesis that auditors would be at least as confident in misrecognition as they were in accurate recognition. These results appear to form several identifiable response patterns.[8]

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[6] The subjects of this experiment came from four levels of experience within the subject firm. The ranges of time with the firm by staff level were: assistant 0.16–0.33 years; staff 0.58–5.50 years; seniors 1.08–5.25 years; managers/partners 4.25–10.00 years. Recent work by cognitive psychologists indicates that there are differences among levels of experience in terms of the structure and function of memory (see Glaser [1984] for a review). Glenberg and Epstein [1987] found that experts are more overconfident in self-assessments of their understanding of text. Thus, we might have expected that experience would make auditors worse at evaluating the quality of their memories. We analyzed both the level of experience within the subject firm (assistant, staff, senior, and manager/partner) and the self-rated familiarity with manufacturing clients as explanatory factors. Neither factor was statistically significant.

[7] This data is not a repeated measure since each subject's pattern of RESPONSE codes was idiosyncratic. The interaction of RESPONSE and ITEM TYPE is the conditioned reply by subjects that must be examined in order to establish accuracy of response.

[8] In addition, we conducted tests of each of the recognition test items separately to see if particular items caused the results. For none of the eight NEW items were there significant differences in the confidence ratings

One pattern of responses involves comparisons between accurate codings of NEW items and each of the six possible memory errors. For the four memory errors involving EXPLICIT and NEW items, the confidence ratings did not differ significantly from the mean confidence rating of NEW items coded as "new." If an auditor erroneously coded NEW items on the current audit (coding "explicit" or "valid summary"), there is the risk that extraneous or incorrect evidence will be used in making subsequent judgments based on the mental representation of the evidence. The data suggest that this type of error may be infrequent which mitigates its practical importance for practitioners.

When confidence on the two erroneous responses for INFERENCE items are compared to confidence for accurate responses to NEW items, the mean confidence ratings for the errors are significantly higher. Overall, the results indicate an undue lack of confidence in the accuracy of identification of items as being "new"; and a surfeit of confidence when the mental representation being probed resulted from an inference. This lack of confidence in identifying items as "new" may reflect a low tolerance for intrusions from other evidence sets.

Most of the comparisons between confidence on INFERENCE items which were correctly coded as "new, not a valid summary" and confidence on the six combinations that were memory errors also support our hypothesis. Subjects were significantly more confident when coding these INFERENCE items as "explicit" than when they accurately coded INFERENCE items as "new, not a valid summary." The exception, the mean confidence rating for EXPLICIT items coded as "new," was significantly lower than the ratings for *two* non-errors, correctly coded EXPLICIT and INFERENCE items.

Overall, the results indicate that the auditors in the study placed too much confidence in erroneous recognition when the mental representation being probed resulted from an inference. This lack of confidence when identifying items as "new" may reflect a low tolerance for intrusions from other evidence sets stored in memory. When this lack of confidence on NEW items is coupled with overconfidence on INFERENCE items, it indicates that subjects were actively examining their recollections for intrusions and must have been fairly certain whenever they replied that an INFERENCE item was "explicit" or a "valid summary," even if they were incorrect.[9]

The highest rated confidence was for errors on INFERENCE items coded as "explicit." This result strongly supports our hypothesis and may be a particularly disconcerting finding for the audit profession. Each INFERENCE item was contradicted in the workpapers. Subjects coding INFERENCE items as "explicit" would have to have confused their own

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across the three possible responses. On seven out of the eight EXPLICIT items, subjects were most confident when their responses were accurate; in six of these cases their confidence in accurate responses was significantly greater than one of the error responses and in three of these cases significantly greater than both of the error responses. Subjects were never most confident in accurate responses to INFERENCE items. On five of the eight items they were least confident in an accurate response, three of these being rated significantly lower than the highest rated (inaccurate) response.

[9] It should be noted that subjects might have assessed different risks for various coding errors and used different confidence cut-offs for each possible response. Alternatively, the low confidence subjects exhibited in responding "new" might show that they were using filters to catch extraneous information and were more certain once an item passed those filters. Since we have no way to test these suppositions, comparisons of confidence involving different responses have to be made with care.

conclusions with observable pieces of audit evidence, and to have included specific representations of such conclusions within their memory frameworks. Since the subjects had the responses "new, not a valid summary" and "valid summary" also available, their recognizing the contradicted implication and coding INFERENCE items as having been "explicit" in the original is evidence that their memories of these particular items included a specific representation of the implication of what they reviewed, a representation that must have been derived from their inferences. In practice, a tendency to believe inferences or other items that were not observed were in fact explicitly reviewed would reduce the quality of any subsequent judgments based on those beliefs. If, as appears to be the case, auditors tend to confidently confuse their own inferences and conclusions with explicitly observable, source evidence, their judgments will be poorly supported.[10]

The pattern that was not consistent with our hypothesis involved comparisons with EXPLICIT items correctly coded as "explicit." These items were the second most highly rated items. In five of six comparisons between the mean confidence rating for correctly coded EXPLICIT items and confidence for items that were memory errors, the non-error was significantly higher. The high ratings for these items indicate that when the subjects were correct about evidence that they had seen, they were very confident. Only in this case is the auditors' high confidence level potentially beneficial, since in such cases it would provide efficiency and effectiveness because the auditors' choice to rely on their memories rather than refer back to the workpapers would be appropriate.

Another way to view the data is in terms of the calibration of auditors' confidence in their recognition accuracy, which is analogous to "calibration of comprehension" [Glenberg and Epstein, 1985]. That is, higher confidence should be associated with higher recognition accuracy, and as one's accuracy in recognizing items declines so should one's confidence. Figure 1 shows the relation between recognition accuracy, in terms of percentage correct, and the confidence ratings (on a nine-point scale) for each of the three types of items. The subjects appear to be well calibrated for EXPLICIT items; their confidence rose with their accuracy. The calibration for NEW items is not good since subjects were very underconfident, but the location of the curve suggests that they were relatively more accurate, though miscalibrated. Note that the calibration curve for the INFERENCE items has a negative slope. As the subjects' recognition accuracy decreased, their confidence in their memory processes increased. This again indicates that the subjects were unable to distinguish between inferences that they had made and items that they had actually seen. It may be that either when an inference is made or during the process of matching between the to-be-recognized item and the stored inference, that an auditor comes to believe the inference represents something observed.

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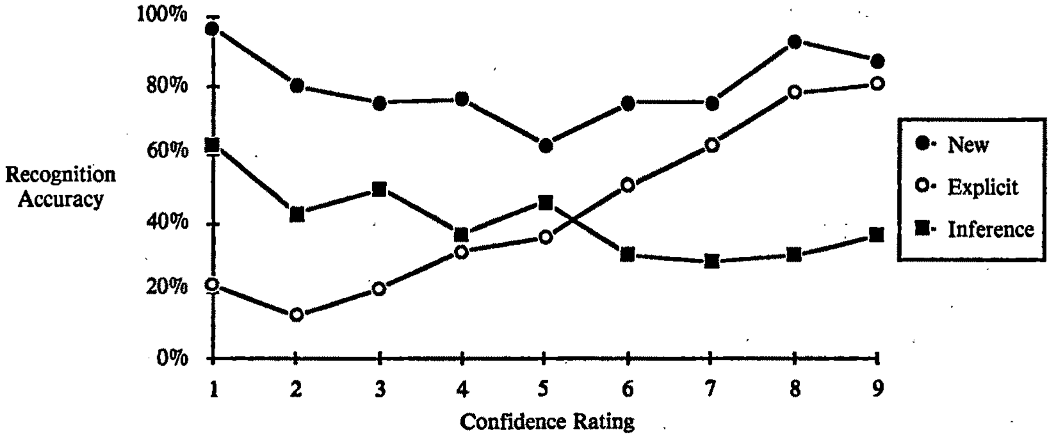
[10] The use of a recognition test provided direct evidence about the representation for the evidence that subjects had in memory, but cannot tell if auditors would also access that particular representation if asked to recall that area of the evidence. The fact that what could only have been an inference, never having been observable, was so often confused with what was actually explicitly stated in the workpapers lends credibility to the arguments that if any memory of the evidence were to be retrieved at all, it would be this one; and that the inferences we supplied in the recognition test were for all practical purposes identical to those made by subjects on their own.

FIGURE 1

CALIBRATION CURVES FOR EACH ITEM TYPE, WHICH WERE THE ITEMS USED IN THE RECOGNITION TEST



IV. CONCLUSIONS

This study was designed to test whether auditors are at least as confident in relying on inaccurate memories of audit evidence as they are when relying on accurate memories. Eighty-five practicing auditors were asked to review a set of hypothetical audit workpapers, then after one day's delay respond to a recognition test, and rate their confidence in their memories. They were asked to use the confidence rating to reflect their willingness to rely on their memories rather than on reviewing the workpapers or source documents again. Generally, auditors are at least as confident in their incomplete and inaccurate memories as they are in their accurate memories. The exception is when auditors accurately recognize evidence that they have in fact seen. Auditors were most confident when they accurately recognized evidence that they had previously seen and when they confused their own inferences with actually observable evidence.

The general tendency toward misplaced confidence could lead to poor judgments when the accumulation of evidence is finished and the auditor undertakes the formulation of an opinion on an account balance, an accounting cycle, or the financial statements taken as a whole. Documentation and review standards can mitigate but may not completely overcome the potential effects of an inappropriately high level of confidence.

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Selection of GAAP or RAP in the Savings and Loan Industry

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ABSTRACT: This study examines the choice of a regulatory accounting principle (RAP) in contrast to generally accepted accounting principles (GAAP) with respect to loan loss recognition in the savings and loan industry. RAP was permitted by the Federal Home Loan Bank Board for Savings and Loans (S&Ls) in the early 1980s. Many S&Ls selected this alternative to GAAP. We examine four factors, conditioned by accounting regulations in the S&L industry setting, hypothesized to explain the accounting choice. All of the factors are significant in logistic regression tests in which the choice of RAP or GAAP was the dependent variable. The results are consistent with the conclusion that S&Ls chose to violate GAAP when regulatory constraints induced a conflict between GAAP requirements and the economic welfare of the firm.

DURING the period of high interest rates in the early 1980s, savings and loan associations (S&Ls) faced a choice between using GAAP or a regulatory accounting principle (RAP) that violated GAAP but was permitted by the S&Ls' regulator, the Federal Home Loan Bank Board (FHLBB). RAP permitted deferral of loan sale losses, while GAAP required that these losses be recognized in the period of sale. The FHLBB alleged that RAP would permit S&Ls to sell low interest loans in secondary markets, thereby improving cash flows, but without violating minimum equity constraints established by Congress and the regulatory agency. By selling their low interest loans, S&Ls were able to recover previous taxes and increase loan origination fees.

The FHLBB authorized RAP beginning October 1, 1981 in hopes of providing relief to financially troubled S&Ls suffering from a negative spread between rates paid to depositors and loan yields.[1] At that time, the attractiveness to S&Ls of selling loans below book value was diminished because GAAP required that losses be recognized in the

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[1] In October 1984, the FHLBB placed a sunset provision on the use of RAP such that, after October 24, 1984, S&Ls were prohibited from amortizing losses on new sales of mortgages. S&Ls were permitted to continue the practice on loans that occurred prior to the sunset date. Two apparent reasons existed for the revocation of RAP. First, interest rates had dropped substantially, relieving some of the financial pressure on the industry. Second, the FHLBB received considerable adverse publicity about RAP and continued to receive pressure from the accounting profession to revoke the procedure.

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period incurred. Recognition of these losses would have placed some S&Ls in violation of minimum net worth requirements [FHLBB, 1981]. Such violations could have resulted in forced liquidation or merger. The decision to permit RAP was accompanied by a reduction in the minimum net worth requirement to three percent, the lowest amount permitted by Congress. Accordingly, any further reduction in the minimum net worth constraint would have required an act of Congress, an unlikely event at that time. Therefore, the FHLBB focused its attention on accounting procedures as a means of avoiding the constraint imposed by Congress and argued that GAAP failed to recognize the "true economic consequences of a sale and reinvestment of proceeds" and amplified the economic problems of S&Ls [FHLBB, 1981].

During this period, some S&Ls chose to adopt RAP in violation of GAAP. Factors associated with this decision should be of interest to accounting regulators, auditors, and others who are concerned with management selection of accounting procedures. We posit that the S&L industry institutional setting created economic incentives for managers to choose between RAP and GAAP. Thus, the RAP/GAAP decision provides a unique opportunity to examine the process by which accounting choices are made. This study describes several factors that are hypothesized to be associated with management's choice between GAAP and RAP. Empirical data from 113 randomly selected S&Ls are used to test the explanatory ability of the hypothesized factors.

The next section of the paper describes the institutional setting and the costs of adopting RAP. Explanations of the accounting choice decision are considered in the second section. The third section describes the sample and data, while Section IV presents the research method and test results. Section V provides a discussion of the results.

I. The Industry Setting

Significant cash flow incentives existed in the early 1980s for S&Ls to sell their low yield loans. Interest rates were at historic highs so that the book values of loans were greater than their market values. By selling low yield loans, an S&L would report immediate tax losses and could recover previously paid and, in some cases, future income taxes. The S&L could use the loan sale proceeds and tax refunds to generate new loans and loan origination fees. By selling these new loans in secondary markets, the cycle could be repeated. The FHLBB estimated that $5 billion would be available to S&Ls in tax benefits in 1981 alone [U.S. League, 1981]. The magnitude of the cash flow benefits for a S&L would depend on the amount of low yield loans in the S&L's portfolio, the amount of current tax liability, the amount of prior taxes paid in the past ten years, and the present value of any future tax savings, in addition to the amount of loan origination fees expected to be generated.

S&Ls were paying high deposit rates and many were close to their minimum net worth requirements. The losses recognized on the sale of low interest loans under the provisions of GAAP would have driven many S&Ls below their net worth requirements. For this reason, the FHLBB intervened to permit loan loss deferrals for regulatory reporting purposes. Under the provisions of RAP, such losses would be amortized over the average remaining life of the loans sold. The resulting negative effect on current income and equity was likely to be far less than the positive effect of the recovery of tax payments and the new origination fees for many S&Ls. Thus, RAP effectively "unfroze" the loan portfolios of many S&Ls by permitting them to sell their loans without violating their net worth requirements.

The problem faced by the S&Ls and the FHLBB, which would have to oversee the disposition of the failed S&Ls, was created by the Congressional restriction on net worth, not by accounting requirements *per se*. However, the costs to the FHLBB of altering the accounting requirements were substantially lower than those of altering Congressional requirements. The net worth requirement was a simple, low cost means for Congress to provide depositors some assurance that their funds were not at high risk. Elimination or reduction of the net worth requirement would have provided another signal of the financial problems faced by an industry that was already being examined skeptically by many depositors.[2] Since the FHLBB determined how the net worth requirement was calculated, it was a simple matter to change the accounting procedures and argue that the accounting procedures were the root of the problem.

Clear economic incentives existed for S&L managers to adopt RAP; however, only about half of federally regulated S&Ls adopted this procedure, suggesting that the net benefits of adoption were not perceived to be positive by the managers of many of these organizations. The question is: Why did some S&Ls adopt RAP while others did not?

II. INCENTIVES TO ADOPT RAP

This section describes four factors hypothesized to be associated with the decision to adopt RAP and two control variables. The hypothesized factors were identified from an analysis of the institutional setting in which S&Ls operate and from earlier positive theory studies which have assumed that managers are rational, evaluative, self-interest maximizers (see Watts and Zimmerman [1986] for a summary).

Tax Benefits and Net Worth Constraints

Tax benefits were a major economic incentive for managers to dispose of low yield loans. The tax refunds that result from the losses on the sales of these loans, along with origination fees from lending the proceeds from the sales, would increase the cash position and future profitability of the S&L. Improvements in cash flow and profits would be expected to be translated into increases in management compensation and job security for managers. The magnitude of the benefit would be a function of the extent to which tax payments could be recovered from current, past, and future periods.

Many S&Ls faced difficulty in meeting the minimum net worth required by Congress. RAP was a mechanism to overcome this barrier. The incentive to adopt RAP resulted from the concurrent existence of (1) potential tax benefits that could be recovered by sale of low interest loans, and (2) close proximity to the minimum net worth requirement. Firms described by both conditions would have an incentive to sell the loans to increase cash flows and an incentive to adopt RAP to overcome the minimum net worth constraint. Firms that could not obtain the tax benefits or that were not facing the minimum net worth constraint would have little incentive to adopt RAP.

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[2] On June 30, 1981, the S&L industry reported approximately breakeven results for the first six months of 1981. By the end of 1981, the U.S. League of Savings Associations reported that only approximately 17 percent of federally regulated S&Ls remained marginally profitable. The industry lost $6 billion in 1981 and $5.6 billion in 1982 [Carron, 1983].

Experience in Secondary Market and Net Worth Constraints

Not all S&Ls had the same ability to sell loans in the secondary market. Firms with no experience in the secondary market would incur higher costs of transacting in the secondary market and, hence, would receive less benefit from adopting RAP. Participation in the secondary loan market is costly. Contacts must be established, contracts must be written, transactions must be processed expeditiously, and hedging may be needed to prevent avoidable losses. Those S&Ls that were active in the secondary market before RAP was permitted had an advantage over those that had not been as active.

As in the case of the expected tax benefits, the incentive to adopt RAP was conditioned jointly on the net benefit associated with prior secondary market experience and the proximity of the S&L to the minimum net worth requirement. Firms with secondary market experience and which were constrained by their net worths would have incentives to adopt RAP in order to take advantage of their market experience.

SEC and FHLBB Regulations

Stock S&Ls having over 500 stockholders are regulated by both the FHLBB and the SEC [Bush and Nowesnick, 1981]. Accordingly, if a stock S&L were to adopt RAP, in order to avoid a qualified opinion that would be unacceptable to the SEC, it would have to place two different sets of financial statements in the public domain, one to the SEC and stockholders under GAAP and another to the FHLBB under RAP. These statements would be inconsistent with respect to total assets, net worth, and net income. Two sets of statements increase the risk that dissatisfied stockholders would use misleading financial data as a basis for legal action [Frank, 1982]. That RAP was cited as being a "deceptive" accounting practice is easy to document (e.g., Kaplan [1981] and Bennett [1984]). It follows that a publicly traded S&L would consider this risk before adopting RAP and would be less likely to adopt RAP than other S&Ls, *ceteris paribus*.

S&Ls that are not SEC regulated could have elected to issue RAP based financial statements without having to issue a separate set of GAAP based statements. Most of these S&Ls are mutually (depositor) owned. The adoption of RAP would have led to a qualified audit opinion as to GAAP statements issued to depositors. The qualification and adoption of RAP may have been perceived by some depositors as a signal of financial difficulty [Jacobe, 1983]. These firms may have been at risk of losing depositors and could have opted to issue GAAP based statements to their depositors to avoid the qualification and to issue RAP based statements to the FHLBB to take advantage of loan loss deferrals. Further, having two sets of financial statements in the public domain would have been less costly for mutual than stock companies because of the SEC requirements on auditor opinions.

However, mutual S&Ls would still have had to weigh the cost of receiving a qualified opinion under RAP against the cost of reporting a net worth figure diminished by the immediate recognition of the entire loss under GAAP. One incentive to adopt RAP was that it enabled S&Ls to report a more favorable actual versus required net worth position to depositors. This helped assure depositors that the S&L was less likely to experience regulatory intervention. Reporting the losses to depositors under GAAP would not have reflected the S&L's net worth position with respect to its regulators. Therefore, it is likely that most S&Ls adopting RAP would elect to report to depositors using RAP, not GAAP. Interviews with S&L managers, FHLBB officials, large audit firms and data collected in this study all revealed that the issuance of two sets of statements was rare.

Auditor Position on RAP

Auditors had an opportunity to influence an S&L's decision to adopt RAP, and auditors had incentives to be involved in the decision because of their own legal risks. Also, auditors had some flexibility in the wording of their audit opinions for S&Ls that adopted RAP. The costs to managers of defending their decisions to boards of directors and of overcoming the effect on depositors of the wording of the audit opinion were related to the auditor's position on the adoption of RAP. These costs would have been higher for managers whose auditors were strongly opposed to RAP.

Auditor risk with respect to the S&L industry was already high during the early 1980s because of the financial condition of the industry [Jacobe, 1983]. Also, there was widespread opposition to RAP in the profession [Bush and Nowesnick, 1981]. Accordingly, auditors had incentives to oppose the adoption of RAP by their clients. These incentives were tempered by the perceived net benefits of RAP to the client, the value of the client, and the probability of loss of the client. These issues resulted in auditing firms adopting different strategies with respect to client use of RAP.

The Appendix contains examples of differently worded audit reports that are indicative of these strategies. The willingness of the auditor to go along with the decision to use RAP would make the choice easier for management. Managers of S&Ls whose auditors were lenient in their views on RAP adoption would be more likely to adopt RAP, *ceteris paribus*, than would be other managers. Nevertheless, the cause and effect between auditor position on RAP and RAP adoption is not unambiguous. S&L managers could have selected their auditors, in part, because of their willingness to accept RAP adoption.

However, most S&Ls in the present sample did not appear to have selected their auditors because of the auditors' views on RAP. Information about auditor changes was obtained from 87 of the S&Ls. Only 12 of these changed auditors during 1981–1985. Auditor changes prior to 1981 would not have involved views about RAP since it was not discussed as a reporting alternative until the middle of 1981. Four of the 12 S&Ls that changed auditors adopted RAP and none of these firms indicated in correspondence with us that the auditors' views on RAP was part of their decisions.[3] Management's consideration of the auditor's position on RAP would still have been a factor in the decision to adopt RAP, whether the auditor's position was considered before or after the auditor was selected.

The audit opinion was only one way in which the auditor could have influenced manager decisions. Interviews with S&L managers suggested that the S&Ls were likely to have relied extensively on their auditor's advice during the transition toward deregulation and that they were unlikely to adopt major accounting changes without consultation with their auditors. Auditor support would have been useful in obtaining support for accounting changes from boards of directors.

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[3] The four RAP adopters indicated that they changed auditors in order to improve the level of audit services available. Three of the four changed from local to national audit firms.

Control Variables

In addition to the four factors hypothesized to be associated with the probability of RAP adoption, two other variables were included in the study for control purposes.[4] These variables, size, and a leverage ratio, have been shown to be important explanatory variables in other accounting choice studies (e.g., see Holthausen and Leftwich [1983]). While there is not a strong theoretical rationale for including the variables in the S&L model, both are included as control variables since they may proxy for various attributes of the firm, and their absence might result in a correlated omitted variables problem.

III. DATA, MEASURES, AND METHOD

Data

Data were obtained from the FHLBB report tape for the semiannual period ending June 30, 1981 and from mail questionnaires. FHLBB tapes contain detailed financial data that each federally regulated S&L must submit to its district FHLB every six months. The date was chosen as the last semiannual reporting date prior to the authorization of RAP. Any subsequent data would be distorted by the use of RAP.

The sampled S&Ls were asked by letter to participate in a direct mail survey consisting of four questionnaires. Three identical questionnaires were mailed to the chief executive, finance, and loan officers of each S&L. These surveys requested data about participation in the secondary markets, SEC regulation, and the S&L's audit firm's support for RAP. A fourth questionnaire requested data about income taxes paid by the S&L during 1971–1980 which were not contained on the FHLBB tape.[5] The questionnaires were developed after structured interviews with 16 S&Ls of different sizes in Iowa and Illinois cities with different demographic attributes. These interview data were not included in the final sample.

Questionnaires were mailed to 189 S&Ls selected randomly from the U.S. League of Savings Associations' 1984 directory. Of the 141 (74.6 percent) respondents, 24 were eliminated because of partially or incorrectly completed questionnaires and four were eliminated because of inconsistencies in the responses of the officers. The final sample consisted of 113 S&Ls, 59 of which had adopted RAP.

Eight financial measures were examined to assess the representativeness of the sample. A comparison of these numbers for the sample and the population of S&Ls on the U.S. League of Savings Associations' 1984 directory is provided in Table 1. The table indicates little difference between the sample and the population measures. Only the mortgage loan/total assets ratio was significantly different. The magnitude of the difference in this ratio (1.7 percent) was small relative to the population ratio mean of 82.3 percent. Accordingly, the sample appears to be representative of the population from which it was drawn.

Explanatory Variables

Four explanatory factors were examined in the study. First was the interac-

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[4] Management compensation arrangements were considered as a possible explanatory factor in addition to the other factors. However, we found that bonus contracts tied to accounting numbers were very rare in the industry. Accordingly, a strong theoretical linkage between RAP adoption and compensation was not apparent.

[5] Copies of the questionnaires are available from the authors.

TABLE 1

SAMPLE AND POPULATION ATTRIBUTES

(1981)

($n=113$)

Variable	*Sample Mean*	*Population Mean*[a]	*Difference*	*t-statistic*
Total Assets	1.932[b]	1.651[b]	.280[b]	1.030
Net Worth/Deposits	0.035	0.038	.003	1.139
Mortgage Loans/Assets	0.841	0.824	.017	3.403[c]
Deposits/Assets	0.849	0.853	.005	0.722
Non-deposit Debt/Assets	0.066	0.057	.009	1.534
Operating Income/Assets	0.051	0.050	.001	0.973
Return on Assets	0.076[d]	0.073[d]	.003[d]	0.176
Return on Equity	0.016	0.012	.004	0.638

[a] Source: U.S. League of Savings Associations' 1984 Directory.

[b] × 10^{-8}.

[c] Significant at the .01 level.

[d] × 10^{2}.

tion between the potential tax benefit that would result if low yield loans were sold and the proximity of the S&L to the minimum net worth requirement of three percent. This construct was measured as: [Tax/Assets] × [.03/(net worth/total deposits)], where Tax is the sum of the S&L's tax expense at June 30, 1981 and the taxes paid over the prior ten year perriod, Assets are June 30, 1981 total assets, and net worth/total deposits is the regulatory net worth measure.[6] The second term in brackets measures proximity to the minimum net worth requirement. The measure was computed in this manner so that a larger value of the variable would represent a greater incentive to adopt RAP relative to a lower value.[7]

The second factor was the interaction of the extent of the S&L's prior participation in the secondary market and the proximity to the minimum net worth requirement. This variable was measured as: Extent × [.03/(net worth/total deposites)], where Extent is the extent of participation measure. This measure was treated as an indicator variable with 0 = never, rare, or occasional prior participation and 1 = often or continuous participation, using questionnaire responses.[8] Accordingly, the interaction term had a value of 0 for firms with little prior secondary market experience and the value of the proximity to minimum net worth for the remaining firms. We hypothesize that a higher interaction measure would be associated with a higher probability of RAP adoption, *ceteris parabus*.

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[6] One of the reviewers recommended an alternative formulation of the tax benefit variable (tax benefit × percent of portfolio in fixed rate mortgates). Our discussion with FHLBB officials indicated that the alternative formulation was reasonable but would have no effect on this study. Virtually the entire portfolios of S&Ls were composed of fixed rate loans as of June 30, 1981. Variable rate loans became popular soon after this time in response to regulations easing restrictions on mortgates.

[7] S&Ls could also benefit from a reduction in future taxes. However, the amount of these taxes could only be estimated from prior payments. Since our estimates of future payments would necessarily be directly dependent on the level of prior payments, these estimates would not have a substantial effect on the relative measures of positive tax benefits computed from past and present taxes and were not included in our estimate of tax benefits.

[8] Prior secondary market participation, SEC regulation, and auditor attitude toward RAP were included as indicator variables in the models reported in this paper to avoid scaling problems associated with categorical responses. Using the categorical responses directly would require the assumption that the difference between values such as "never" and "rarely" were identical to the difference between "rarely" and "occasionally." Such an assumption did not appear to be reasonable. Results, not reported in this paper, using arbitrary scale values (1 = never, 2 = rarely, etc.) were similar to the reported results.

The third factor was SEC regulation as measured by an indicator variable from responses to the questionnaires, with 0=not SEC regulated and 1=SEC regulated. We hypothesize that non-SEC regulated firms would exhibit a higher probability of RAP adoption, *ceteris paribus*.

The fourth factor was manager perception of audit firm support for RAP as measured by an indicator variable from questionnaire responses with 0="opposed" (strongly or weakly) and 1="not opposed" (neutral, weakly, or strongly favored). We hypothesized that firms in the not opposed group would exhibit a higher probability of RAP adoption, *ceteris paribus*. The perceptions about audit firm support for RAP of the three respondents were averaged to form an organizational score. While aggregating individual responses serves to reduce measurement error due to perceptual bias, it also raises the possibility that combining widely disparate responses will result in unreliable measures [Robinson, 1950]. The respondents were all managers who were asked to report on the position of the firm's auditors on an accounting choice. Thus, the respondents were relatively homogeneous and the phenomenon reported on did not differ from person to person in the same firm. Finally, a test for interperceiver reliability was performed in which the average within firm variance was compared to the between subjects variance. This test (Cronbach's Alpha) produced a score of .77.

Two control factors were included in the model: size and leverage ratio. Size was measured as total assets, and the leverage ratio was measured as net worth /total liabilities (including deposits).[9] These variables used data from the FHLBB tapes.

Descriptive statistics and a correlation matrix for the independent variables are provided in Table 2.

IV. Method and Results

Method

Multivariate logistic regression tests were used to test the hypothesized associations and univariate *t*-tests and Kruskal-Wallis tests are presented for descriptive purposes because of potential intercorrelations and nonnormality of the data. Multivariate logistic regressions provided information about the marginal explanatory power of each independent variable. RAP adoption is coded as one and nonadoption as zero. Therefore, the logistic regression model produces probabilities of RAP adoption for each observation. A chi-square test statistic is produced for evaluation of the model's explanatory ability.

Univariate Tests

Univariate test results for each of the independent variables are presented in Table 3. The differences between the means of the GAAP and RAP groups for each of the variables are in the hypothesized directions in all cases. The results for the parametric and nonparametric tests are similar for all variables. In particular, all of the explanatory variables are significant at the .05 level, and

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[9] Debt covenants have been examined as explanatory variables in other studies. However, debt covenants based on debt/equity ratios or proximity to net worth are uncommon in the S&L industry.

TABLE 2
DESCRIPTIVE STATISTICS
(1981)
($n=113$)

Variable	*Mean*	*Std. Dev.*	*Min.*	*Max.*
1. Tax benefit × net worth ratio	.0049	.0028	.0000	.0209
2. Market experience × net worth ratio	.3246	.4088	.0000	2.5166
3. SEC regulation	.1062[a]			
4. Auditor not opposed to RAP	.8584[a]			
5. Size[b]	1.9343	2.8917	.0637	14.5187
6. Leverage ratio	19.8663	11.3039	7.5289	88.1406

SPEARMAN CORRELATION COEFFICIENTS[c]

Variable Number

	2	*3*	*4*	*5*	*6*
1	.106	−.245	.185	.477	−.079
2		.200	.065	.363	.474
3			−.272	−.045	.222
4				.035	−.046
5					.046

[a] The mean is the percentage of total observations with values of one for these dummy variables.

[b] Total assets × 10^{-8}.

[c] Critical values are .23 and .19 at the .01 and .05 level, respectively.

one of the control variables, size, is negative and significant at the .08 level.

Logistic Regression Results

Logistic regression test results are provided in Table 4. Consistent with the univariate test results, all of the coefficients of the explanatory variables are in the hypothesized direction. Five of the six variables are significant at the .05 level. Only the leverage ratio was insignificant at $p=.20$. The interaction variables were the most significant variables in the logistic regression tests. Overall, the logistic regression results indicate that all of the explanatory variables contribute incrementally to explaining the choice of RAP when the other explanatory factors are controlled.

The main effects for the interaction terms were not included in the model since the theory did not include them as explanatory factors. When the main effects were added to the model, they proved to be insignificant (*p*-values>,20), consistent with the theory.

Dropping the control variables from the model had little effect on the remaining variables. The coefficients and levels of significance for each of the four explanatory variables differed immaterially from those reported in Table 4. The model chi-square was 34.08 with four degrees of freedom (*p*-value<.0001).[10]

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[10] Stepwise logistic regression was used to examine the effects of adding variables to the model on an incremental basis. Each of the independent variables entered the model except the leverage ratio. The coefficients and levels of significance of the variables did not change appreciably as additional variables were added.

TABLE 3

TESTS OF ASSOCIATION BETWEEN GAAP/RAP ADOPTION AND EXPLANATORY VARIABLES

(1981)

($n = 113$)

Explanatory Variable[a]	*Group*	*Mean*	*Std. Dev.*	*F-statistic (Chi-Square)*	*P>F (p>Chi-Square)*
Tax-Net Worth	GAAP	.0040	.0024	11.60	.0009
	RAP	.0057	.0030	(12.95)	(.0003)
Market-Net Worth	GAAP	.2540	.4122	3.14	.0790
	RAP	.3892	.3982	(5.17)	(.0230)
SEC Regulation	GAAP	.1852	.3921	7.11	.0088
	RAP	.0339	.1825	(6.74)	(.0094)
Auditor	GAAP	.7407	.4423	12.92	.0005
	RAP	.9661	.1825	(11.68)	(.0006)
Size	GAAP	2.1853	3.3864	0.78	.3798
	RAP	1.7046	2.3571	(3.18)	(.0748)
Leverage	GAAP	19.3906	11.5344	0.18	.6707
	RAP	20.3017	11.1700	(.053)	(.4654)

[a] Explanatory Variables:
Tax-Net Worth = Maximum tax benefit × proximity to net worth ratio.
Market-Net Worth = Prior experience in secondary loan market × proximity to net worth ratio.
SEC Regulation = SEC regulation (0 = no, 1 = yes).
Auditor = Auditor support for RAP (0 = no, 1 = yes).
Size = Total assets $\times 10^{-8}$.
Leverage = Net worth/total liabilities.

In order to test the explanatory power of the model estimated in Table 4, we examined the ability of the model to correctly classify firms as RAP adopters. A modified jackknife procedure was used for this purpose. One hundred iterations of the model were run in which approximately half of the observations were randomly selected and model coefficients were computed. The parameters were used to predict the classifications of the remaining observations as RAP or GAAP firms.

This procedure produced a correct classification rate with a mean of .7484 and a standard deviation of .0512. Of the 100 iterations, 68 produced classification rates of between 70–79 percent. Fifteen were between 60–69 percent, and 17 were greater than 80 percent. The model appeared to produce reasonably stable results. The proportional chance criterion for the model produced a naive correct classification rate of .5009 (see Morrison [1969]). A t-test of the difference between the observed and naive rates results in a t-statistic of 48.33 and is significant at the .001 level. Accordingly, we conclude that the model is capable of accurately classifying S&Ls as RAP or GAAP adopters with a significantly better than chance probability.

V. DISCUSSION

This study documents that the decision by managers of S&Ls to adopt RAP was jointly consistent with several economic factors. Adopters, on average,

TABLE 4
LOGISTIC REGRESSION ESTIMATES FOR ASSOCIATION BETWEEN GAAP/RAP ADOPTION AND EXPLANATORY VARIABLES
(1981)
(n=113)

Explanatory Variable	*Predicted Sign*	*Estimated Coefficient*	*Std. Err.*	*Chi-Square*	*Probability*
Intercept		−3.503	1.28	7.51	.0061
Tax-Net Worth	+	356.18	125.94	8.00	.0047
Market-Net Worth	+	2.461	.919	7.18	.0074
SEC Regulation	−	−3.059	1.436	4.54	.0331
Auditor	+	1.973	.905	4.75	.0293
Size	−	−.192	.086	4.95	.0260
Leverage	+	.0001	.034	0.00	.9981

Model Chi-Square$^{(6)}$=39.56
Model p-value=.0001

Dependent variable=0 if GAAP used, 1 if RAP used.
Explanatory variables:
Hypothesized factors:
Tax-Net Worth=maximum tax benefit × proximity to net worth ratio.
Market-Net Worth=prior experience in secondary loan market × proximity to net worth ratio.
SEC Regulation=SEC regulation (0=no, 1=yes).
Auditor=auditor support for RAP (0=no, 1=yes).
Control variables:
Size=total assets $\times 10^{-8}$.
Leverage=net worth/total liabilities.

had a larger potential tax benefit that could be obtained by selling low yield loans in conjunction with closer proximities to minimum net worth requirements. Also, adopters had more extensive prior secondary market experience in selling loans in conjunction with closer proximity to minimum net worth requirements than did nonadopters. Both of these interaction terms suggest that adopters had cash flow incentives to sell low interest loans but needed to adopt RAP in order to avoid violation of minimum net worth requirements that would result from GAAP based recognition of losses for financial reporting purposes.

Adopters were less likely than nonadopters to be SEC regulated and, therefore, were not subject, to the same extent, to the costs associated with issuing two sets of financial reports. Finally, on average, adopters faced less resistance (as perceived by S&L managers) from their auditors with respect to selecting RAP than did nonadopters. These findings are consistent with earlier studies that have shown that managers select and lobby for accounting alternatives that are consistent with their self-interest.

The results suggest that auditors may exert influence over the selection of accounting procedures by managers. The auditor's perceived position on RAP was a highly significant variable in the models. We cannot determine the accuracy of managers' perceptions; however, it seems reasonable to assume that the auditors of the RAP adopters did not pose a major obstacle to managers' choices. This is a somewhat surprising result since auditors are charged with providing an opinion of the fairness of presentation of financial statements in conformity with GAAP. When managers choose accounting alternatives that are unambiguous departures from GAAP, we would anticipate that auditors would take a strong position against the choice. This does not appear to have been the case, at least in managers' perceptions, with RAP. Perhaps, auditors' opinions about RAP were influenced by their perceptions of its key role in maintaining the continued existence of their S&L clients.

The possibility that some S&Ls selected their auditors with some foreknowledge of their attitudes toward accounting procedures cannot be ruled out completely. Under this scenario, the accounting choice decision by managers would influence the auditor choice decision rather than the auditor choice influencing the accounting choice. However, the evidence seems to suggest that this was not the case with RAP, and the willingness of some auditors to accept client use of nonGAAP procedures was associated with the accounting choice decision.

This study does not permit consideration of the issue of auditor influence of accounting choices in more depth. Other factors, such as materiality, may play a role in these decisions. However, we conclude that the role of auditors warrants further consideration in examining accounting choice decisions. This situation suggests that managers' decisions are not likely to be independent of those of their auditors. It is also an open question as to whether auditor decisions are independent of their clients' preferences and/or financial welfare.

The industry setting in this study permitted a rare opportunity in which the actual regulatory requirement could be included in an accounting choice model. The interaction terms, indicating that firms closer to their regulatory constraints were more likely to choose RAP, provided empirical support for the importance of the regulatory construct in agency theory. In the situation examined, regulatory constraints induced a conflict between GAAP compliance and the economic welfare of the firm. In the majority of cases, the conflict resulted in decisions to violate GAAP.

APPENDIX

EXAMPLE AUDIT OPINIONS FOR FIRMS SELECTING RAP

Example 1:

As discussed in Note X, during 19X2, the Association changed its method of accounting for gains and losses from sales of mortgage loans from recognition when realized to the deferral of such gains and losses as permitted by the Federal Home Loan Bank Board (FHLBB). In our opinion, this method of accounting is not in conformity with generally accepted accounting principles and, accordingly, the Association has not provided reasonable justification for making the change in financial statements prepared for other than filing with the FHLBB [Deloitte, Haskins and Sells, 1982].

Example 2:

As described in Notes 2 and 13 of the Notes to Consolidated Financial Statements, the Association's policy is to prepare its consolidated financial statements on the basis of accounting principles prescribed or permitted by the Federal Home Loan Bank Board. These practices differ in some respects from generally accepted accounting principles, [and] accordingly, the accompanying financial statements are not intended to present [the] financial position and results of operations in conformity with generally accepted accounting principles [Read et al., 1985].

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Security Price Response to Quarterly Earnings Announcements and Analysts' Forecast Revisions

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ABSTRACT: The degree to which earnings changes are thought to be permanent may determine the magnitude of the security price response to a given earnings announcement [Brown et al., 1985; Kormendi and Lipe, 1987; and Easton and Zmijewski, 1987]. This study extends this literature by examining the impact on stock prices of quarter ahead and year ahead forecast revisions, as well as forecast errors. Results indicate that analysts' forecast revisions provide significant incremental explanatory power in a pooled time-series, cross-sectional regression of abnormal returns on forecast errors and analyst forecast revisions. In addition, the fourth quarter announcement appears to provide more information to analysts and investors than interim announcements.

THE accounting literature clearly supports the proposition that stock prices respond to earnings announcements. Unexpected increases in earnings are associated with a rise in stock prices, while unexpected decreases in earnings are associated with a fall in stock prices.[1] The discounted cash flow (DCF) model of finance theory predicts that in an efficient market the value of the firm equals the present value of expected future cash flows. To the extent that earnings announcements are unanticipated, they are likely to provide new information about future cash flow and, thus, to alter the value of the firm. Accordingly, the DCF model predicts that the impact of earnings announcements on stock prices depends on the extent to which all cash flow expectations are altered, and not solely on the current forecast error.[2] Though early work by Beaver et al. [1980] indicated that the response of

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[1] See Watts and Zimmerman [1986] or Brown [1987] for a review of the early literature. More recent contributions include Atiase [1985] and Brown et al. [1987].

[2] Equivalently, as Miller and Rock [1985] note, the impact of an earnings innovation on stock price depends on the extent to which the innovation is viewed as transitory or permanent.

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stock prices to earnings innovations depended on the extent to which the innovation is perceived to be permanent,[3] only recently have the implications of the DCF model been investigated directly (e.g., Brown et al. [1985], Easton and Zmijewski [1987], and Kormendi and Lipe [1987]).

The purpose of this paper is to investigate the extent to which revisions of more distant earnings forecasts, as well as the current forecast error, affect stock prices. Following Brown et al., among others, the IBES monthly summary data base is used to develop proxies for the market's earnings forecasts. By using quarterly earnings forecasts, this paper extends Brown et al. [1985] in two ways. First, the quarterly data make it possible to design more direct tests to determine the relative impact of current forecast errors and forecast revisions on stock prices. Second, it enables examination of whether the fourth quarter is unique in the sense that the information conveyed by fourth quarter announcements has different implications for the permanent earnings hypothesis.

The paper is organized as follows. The next section develops the implications of the DCF model to show that leaving analysts' forecast revisions out of a regression equation designed to model the impact of earnings announcements on stock prices can yield misleading results. Section II briefly reviews recent studies of earnings permanence and stock price reactions. The IBES monthly data are described in Section III and the empirical findings are presented in Section IV. An interpretation of the findings is provided in the concluding section.

I. IMPLICATIONS OF THE DCF MODEL

The DCF model is given by the familiar relation:

$$V_0=\Sigma_{t=1}\{E_0(C_t)/(1+k)^t\}, \qquad (1)$$

where:

V_0 = the value of the firm at time, $t=0$,
E_0 = the expectation evaluated at time, $t=0$,
C_t = the random cash flow produced by the firm in period t, and
k = the appropriate rate for discounting the firm's cash flow.[4]

To develop the implications of the DCF model with respect to the permanent earning hypothesis, define time $t=1$ to be an instant after earnings (and cash flow) for period 1 are announced, and $t=1-\Delta$ to be an instant before. Rewriting equation (1) for time $t=1$ gives:

$$V_1=C_1+\Sigma_{t=2}\{E_1(C_t)/(1+k)^{t-1}\}. \qquad (2)$$

(At time $t=1$, C_1 is known so the expectation operator is dropped.) Subtracting $V_{1-\Delta}$ from V_1 yields the change in the stock price due to the earnings announcement,

$$\begin{aligned} V_1-V_{1-\Delta}=&\,C_1-E_{1-\Delta}(C_1)\\ &+\{E_1(C_2)-E_{1-\Delta}(C_2)\}/(1+k)^1\\ &+\{E_1(C_3)-E_{1-\Delta}(C_3)\}/(1+k)^2\\ &+\ldots \end{aligned} \qquad (3)$$

In the absence of restrictive assumptions about how intertemporal cash flow forecast errors are related, equation (3) suggests that the appropriate cross-sectional regression to assess the impact of earnings announcements on stock prices is of the form,

$$\begin{aligned} dV=&\,b_0+b_1{}^*\delta X_1+b_2{}^*\delta X_2\\ &+b_3{}^*\delta X_3+\ldots \end{aligned} \qquad (4)$$

where δX_1 is the cash flow forecast error, $C_1-E_{1-\Delta}(C_1)$, and δX_2 to δX_n are the revisions of the more distant cash flow forecasts.

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[3] A subsequent paper by Beaver et al. [1987] reaches similar conclusions.

[4] We assume here that the discount rate is not affected by earnings announcements, and thus can be assumed constant.

Empirically, a measurement problem arises because the *X*'s represent cash flow, whereas the IBES forecasts are of accounting income. However, if earnings announcements convey all the information necessary to revise cash flow forecasts, substituting earnings for cash flow in equation (4) will change the estimated parameters, but not the R^2 nor the *F*-statistic.[5]

If the higher order terms are omitted from regressions such as equation (4), the estimated parameters of the included variables will be biased, if they are correlated with the excluded variables. In simple regressions where the earnings innovation is the only explanatory variable, the bias that results from omitting the higher order terms is typically not crucial because the hypothesis tests are not based on a specific prediction for the coefficient, b_1. In multiple regressions, however, misleading results may be obtained if the added explanatory variables are correlated with the forecast revisions.

Consider, for instance, the work of Brown et al. [1987]. To assess the impact of measurement error in the proxy for the market's expectation of earnings, Brown et al. use two or more proxies for expected earnings in a regression of the form:

$$dV = b_0 + b_1{*}\delta X + b_2{*}\delta Y + b_3{*}\delta Z, \qquad (5)$$

where δX, δY, and δZ are quarterly earnings forecast errors based on different measures of expectations.

They reach two conclusions. First, they find that if only one explanatory variable is used in equation (5), analysts' forecasts are the best proxy for market expectations in the sense of producing higher R^2s than any one of a variety of time-series forecasts. Second, they report that when the time-series forecasts errors are added to the analysts' forecast errors in a multiple regression, the explanatory power increases significantly. Brown et al. interpret this as evidence of measurement error in the proxy for expected earnings. However, it is also possible that the added terms function as substitutes for the omitted forecast revisions.

II. EARNINGS "PERMANENCE" AND STOCK PRICE REACTIONS

Two approaches have been taken to estimating the relation between the "permanence" of the information in an earnings announcement and the reaction of stock prices. The first approach, used by Kormendi and Lipe [1987] and Easton and Zmijewski [1987], recognizes that if the more distant forecast revisions are omitted from equation (4), then the estimated coefficient, b_1, will be biased upward.[6] Furthermore, the more permanent the information in the earnings announcement, the greater the correlation between the current earnings innovation and revisions of forecasts for future earnings, and the larger the bias. In a cross-sectional regression, therefore, estimates of b_1 should be positively correlated with a measure of the permanence of the earnings announcement.

Kormendi and Lipe [1987] test this permanence hypothesis by using time-series models to develop a measure of the permanence of an earnings announcement. They find that their measure is positively correlated with the coefficient, b_1. Easton and Zmijewski [1987] extend the work of Kormendi and Lipe by using a more sophisticated model of the earnings process which takes account of *Value Line* forecast data to arrive at a measure of the permanent component of an announcement. In addition, they use a random coefficients approach to estimate b_1. Nonetheless, they reach the same conclusion as Kormendi and Lipe: the estimated coefficient, b_1, is positively correlated with the measure of the permanence of the information in the earnings announcement.

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[5] This is strictly true only if earnings and cash flow are linearly related.

[6] The bias will be upward as long as the current earnings innovation and future forecast revisions are positively correlated.

Brown et al. [1985] use annual earnings forecasts from the IBES summary data base to investigate the relative ability of the current innovation in annual earnings and the revision in next year's earnings forecast to explain changes in stock prices over eight to ten month holding periods. They find that the year ahead revision has more explanatory power than the current innovation in two senses. First, when each variable is used separately in a univariate regression, the year ahead revision produces a higher R^2. Second, when the orthogonal component of the year ahead revision is added to the current innovation in a multivariate regression, its estimated coefficient is significantly greater than zero. However, when the orthogonal component of the current innovation is added to the year ahead revision in a multivariate regression, its estimated coefficient is not significantly different from zero. The results, therefore, indicate that all the information contained in the current innovation is contained in the year ahead revision, but not vice-versa.

To explain their results, Brown et al. hypothesize that the current earnings forecast may contain a large "temporary" component relative to the year ahead forecast. They note that although accountants distinguish between "extraordinary" and "ordinary" income, this distinction does not correspond to the economic distinction between "temporary" and "permanent" income. Brown et al. [1985] argue that it is possible that analysts tailor their current earnings forecasts to the accounting number the company will report, and use their year ahead forecasts to convey their expectations about permanent earnings.

With quarterly data, we can examine several questions that could not be adequately addressed by Brown et al. The quarterly data allow computation of both quarter and year ahead forecast revisions, whereas Brown et al. could calculate only the latter. It is possible, therefore, to determine whether both the quarter ahead revision and the year ahead revision convey information not conveyed by the quarterly forecast error. Furthermore, using quarterly data shortens the return observation interval, and thereby potentially increasing the power of the tests (that is, if the effect of reduced noise of a shorter window exceeds that of possible misalignment of the events). Finally, we can investigate whether the relation between stock price changes, forecast errors, and forecast revisions is different for the final quarter of the fiscal year.

III. THE SAMPLE

Firms included in the sample meet four criteria:

1. Mean monthly earnings forecasts were available from the IBES summary forecast data tape (Lynch, Jones and Ryan) for the period September 1984 through September 1986.
2. Quarterly earnings and earnings announcement dates were available on the COMPUSTAT file for the same period.

3. Daily security price and return data were available from the CRSP file for each earnings announcement "event" interval (defined below).
4. Monthly security return data were available from CRSP for the 60-month period preceding each event interval.

In total, 2,777 firm-announcements made by 330 firms met all four criteria.[7]

The IBES summary tape consists of consensus monthly forecasts of analysts surveyed by Lynch, Jones and Ryan. Forecasts for a variety of horizons are available including the current quarter, the next quarter, the current fiscal year, and the next fiscal year. Both mean and median summary forecasts are reported.[8]

The first selection criterion implies that a sample firm has monthly forecasts covering a maximum of nine earnings announcements. The second and third criteria ensure that forecast errors, forecast revisions, and security price returns associated with each earnings announcement can be computed. The fourth criterion guarantees that market model parameters can be estimated in order to compute residual returns for each earnings announcement.

For a typical quarter, earnings are announced within 30 days of the close of the quarter (the period is somewhat longer for fourth quarter earnings).[9] For the IBES consensus forecasts, the timing issues are more complicated. As O'Brien [1988] documents, there is a variable reporting lag. To illustrate the impact of this lag, assume that XYZ, Inc. announces its first quarter earnings on April 17, 1987. Suppose a Merrill Lynch analyst forecasts XYZ's 1987 second quarter earnings on April 8, but Merrill Lynch does not publish the forecast and make it available to Lynch, Jones and Ryan until the end of April. As a result, IBES will include the forecast as part of its May 1987 consensus forecast. Thus, even though the Merrill Lynch forecast is part of the May consensus, it does not reflect the April 17 earnings announcement. If a Dean Witter analyst forecasts XYZ's second quarter earnings on April 22, his forecast, which does reflect the April 17 announcement, is also likely to be included in the May consensus forecast.

In addition to the reporting lag, there is also an aggregation problem which arises because analysts do not release their forecasts simultaneously. The IBES convention is to calculate monthly summary statistics using forecasts received between the third Thursday of the current and the third Thursday of the previous month. For example, the May summary includes forecasts received between the third Thursday in April and the third Thursday in May.

These timing and aggregation issues raise problems for measuring the response of security prices to earnings announcements and earnings forecast revisions. An ideal measure of this response would use a consensus forecast made just prior to an earnings announcement, and another made just after it. Unfortunately, the nature of the IBES summary data imposes restrictions on the research method. To illustrate these restrictions, consider again the XYZ, Inc. example. As shown on the time line in Figure 1, the earnings announcement date is Friday, April 17. Because the third Thursday in April is the sixteenth,

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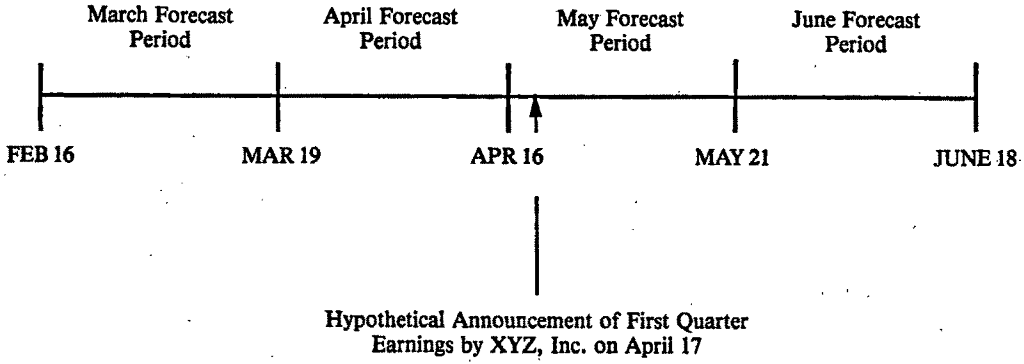
[7] The sample is limited to December 31 fiscal year end firms in order to avoid ambiguities concerning the timing of the one- and two-year ahead forecasts for other than December 31 firms.

[8] For a more complete description of the nature of the IBES summary (annual earnings) data base, see Brown et al. [1985].

[9] See Chambers and Penman [1984] for a detailed discussion of the timing of quarterly earnings releases.

FIGURE 1

EARNINGS ANNOUNCEMENTS AND THE TIMING OF IBES FORECASTS:
AN EXAMPLE USING A HYPOTHETICAL XYZ, INC. ANNOUNCEMENT ON APRIL 17



the April consensus forecast is the latest available preannouncement forecast. However, if the announcement had been on April 10, the latest available preannouncement forecast would have been the March consensus forecast.

If there were no reporting lag, the same convention could be used to choose the postannouncement consensus forecast. Because the April earnings announcement follows the third Thursday in that month, as shown in Figure 1, some of the forecasts in the May consensus were made prior to the announcement. Thus, the June forecast is the first one which would be certain not to include individual analyst forecasts made prior to the earnings announcement. However, if the announcement had been on April 10, the May forecast would have been the first clean postannouncement forecast.

The choice of postannouncement forecast is further complicated by the reporting lag. If the lag is on the order of 34 days (as reported by O'Brien [1988]), then the May consensus would consist primarily of forecasts made in March and April and would never be an appropriate choice as the postannouncement forecast. However, O'Brien used IBES data for a period ending in 1981, and the reporting lag has been considerably shortened in more recent tapes. Karen Waldemar of Lynch, Jones and Ryan believes that during the sample period used here, the average reporting lag was approximately ten trading days. Assuming this is true, some of the individual forecasts in the May consensus are almost certain to have been made prior to April 17. A conservative choice for the postannouncement forecast, therefore, is the June consensus.[10]

Ideally, the forecast error, forecast revisions, and security returns should all be defined over a common time interval. Unfortunately, this is not possible because the postannouncement forecast is not available until at least a month following the earnings announcement. Thus, the earnings forecast error is measured from the last day of preannouncement forecast period to the day following the earnings announcement, while the forecast revision is measured from the last day of the preannouncement forecast period to the last day of the postannouncement forecast period. Returning to the XYZ, Inc. example, the last day of the preannouncement forecast period is Thursday, April 16, while the last day of the postannouncement forecast period is Thursday, June 18. The day following the earnings announcement is Monday, April 20. Finally, the security return, like the forecast error, is measured from the last day of preannouncement forecast period to the day following the earnings announcement. The average length of this interval is 15 trading days.

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[10] Although the same reasoning holds for the second and third quarters, there is an added problem in measuring the preannouncement forecast for the fourth quarter. IBES never reports fourth quarter forecasts in January, even for situations in which the third Thursday in January precedes the earnings announcement. Thus, the December consensus forecast is always chosen as the latest preannouncement forecast for the fourth quarter.

As a result of these procedures, the earnings forecast error and the security returns are affected by the information set, Θ_1, which contains the information disseminated from Thursday, April 16 through Monday, April 20, while the forecast revisions are affected by Θ_1 and Θ_2, which contains information disseminated from April 16 through June 18. The added information, Θ_2, which is included in the forecast revisions, should not produce spurious correlations, because in an efficient securities market the information in earlier security returns should be uncorrelated with the information in Θ_2. However, to the extent that the information in Θ_2 affects the forecast revisions, they will be measured with error from the standpoint of a regression which makes the implicit assumption that both returns and forecast revisions depend only on the information in Θ_1. This error biases the associated coefficients toward zero and reduces the explanatory power of the model.

Before turning to the empirical model, there is an additional conceptual issue to be addressed. Up to this point, it has been implicitly assumed that the chain of causality is from earnings announcements, to forecast revisions, to security prices. That is, security prices are assumed to be endogenously determined by the information in unexpected earnings and forecast revisions. It is possible, however, that the chain runs the other way, at least in part. That is, forecast revisions are affected by the change in security prices associated with an earnings announcement. Unfortunately, this problem of determining the direction of causality could not be avoided even if daily data on analysts' forecasts were available. When an analyst changes a forecast following an earnings announcement, it is impossible to determine the extent to which the revision is based on observed security price movements in addition to the information in the announcement.[11] Nonetheless, as Brown et al. [1985, p. 85] note, there is an economic reason for believing that causality must run primarily from forecast revisions to prices. If the information in the forecast revision could be discerned by costlessly observing the change in price accompanying earnings announcements, then rational agents would have no incentive to employ security analysts.

Empirical Model and Variable Definitions

The empirical version of equation (4) is given by equation (6):

$$\begin{aligned} AR_{it} = {} & \alpha_0 + \alpha_1{*}FE_{it} \\ & + \alpha_2{*}FRQ_{it} + \alpha_3{*}FRY_{it} \\ & + \epsilon_{it} \end{aligned} \tag{6}$$

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[11] Stickel [Forthcoming] reports that analysts are more likely to revise their forecasts following an earnings announcement than before it. The most likely explanation for this finding is that the announcement is informative.

where:

t = an index referring to the announcement quarter ($t=1$ to 9 for the third quarter of 1984 through the third quarter of 1986).

AR_{it} = the abnormal stock return for firm i associated with quarterly earnings announcement t. AR_{it} is measured from the last day of the preannouncement forecast period through the day following the earnings announcement. The abnormal return is computed using market model parameters estimated for 60 months prior to each announcement period.

FE_{it} = the forecast error for firm i and quarterly earnings announcement t. FE_{it}, which is measured over the same time interval as AR_{it}, is given by $(EPS_{it}-E(EPS_{it}|\Theta_0))/P_{it}$, where EPS_{it} is the realized quarterly earnings per share, $E(EPS_{it}|\Theta_0)$ is the mean preannouncement IBES consensus forecast of EPS_{it}, and P_{it} is the security price of firm i on the last day of the preannouncement forecast period (Θ_0 refers to the set of information available on the preannouncement forecast date).

FRQ_{it} = the forecast revision for firm i for quarter $t+1$, made in response to the earnings announcement for quarter t. FRQ_{it} is given by $(E(EPS_{i,t+1}|\Theta_2)-E(EPS_{i,t+1}|\Theta_0))/P_{it}$, where $E(EPS_{i,t+1}|\Theta_0)$ is the preannouncement forecast of EPS for quarter $t+1$, and $E(EPS_{i,t+1}|\Theta_2)$ is the postannouncement forecast of EPS for quarter $t+1$.

FRY_{it} = the forecast revision for firm i for the next fiscal year. FRY_{it} is given by $(E(EPSY_{i,t+k}|\Theta_2)-(EPSY_{i,t+k}|\Theta_0))/P_{it}$, where $E(EPSY_{i,t+k}|\Theta_0)$ is the preannouncement forecast of EPS for the fiscal year which ends in quarter $t+k$, and $E(EPSY_{i,t+k}|\Theta_2)$ is the postannouncement forecast of EPS for the fiscal year which ends in quarter $t+k$. Note that the number of quarters ahead for the subsequent fiscal year depends on the quarter of observation. For example, if the current quarter is the first quarter of the year, the subsequent fiscal year is $k=7$ quarters ahead, but if the current quarter is the third quarter of the year, the subsequent fiscal year is only $k=5$ quarters ahead.

IV. EMPIRICAL RESULTS

Four versions of the model in equation (6) are estimated. The first version is estimated using OLS.[12] The other three versions estimate equation (6) using weighted least-squares and various deflators designed to correct for possible heteroscedastic disturbances.

One potential cause of nonconstant error variances is peculiar to this study, and another is common to cross-sectional event studies. In contrast to most event studies, returns are measured over

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[12] As noted, the independent variables in the undeflated regression are defined by dividing by the share price at the beginning of the event period. Christie [1987] argues that this is the correct approach when the dependent variable is security price return. However, Landsman and Magliolo [1988] suggest that other variable definitions may also be appropriate. As a check for robustness, the independent variables were also defined using expected earnings and earnings lagged four quarters as divisors. The results from these unreported regressions are qualitatively the same as those reported below.

TABLE 1

SAMPLE CORRELATION COEFFICIENTS FOR ABNORMAL RETURNS, FORECAST ERRORS, AND FORECAST REVISIONS[1]

(1984–1986)

(n=2,777)

	AR	FE	FRQ	FRY
FE	0.127			
FRQ	0.101	0.309		
FRY	0.130	0.192	0.245	

[1] *AR*= Abnormal return over earnings announcement interval.
FE= (EPS−Forecasted EPS)/PRICE (with PRICE being the stock price on the last day of the pre-earnings announcement forecast period).
FRQ= (Forecast revision of EPS one quarter hence)/PRICE.
FRY= (Forecast revision of EPS one year hence)/PRICE.
Correlations are estimated using a panel of quarterly observations for 330 firms and data from the third quarter 1984 through the third quarter 1986.

varying intervals determined by earnings announcement dates. Since residual variance presumably increases with the observation interval, the second version of the model deflates all variables by the square root of the number of days in the event period.[13] In the third version, all variables are deflated by the estimated standard deviation of the market model residuals to allow for differences in firm-specific residual variances. The fourth version uses both deflators.[14]

A matrix of sample correlation coefficients for the variables used to estimate equation (6) appears in Table 1. Each of the three explanatory variables is positively correlated with the announcement period return. Not surprisingly, both the next quarter's and next year's forecast revision, *FRQ* and *FRY*, are positively correlated with the forecast error. Furthermore, *FRQ* and *FRY* are also positively correlated. However, no independent variable correlation exceeds 0.31, which suggests that multicollinearity is not a severe problem.

The regression estimates are reported in Table 2. The results for each of the four models are qualitatively similar, indicating that the findings are robust with respect to the choice of deflator. Each coefficient on the three explanatory variables, *FE*, *FRQ*, and *FRY* is statistically significant, with the exception of *FE*'s coefficient in the combined deflator model (panel D). This suggests that all three variables provide investors with new information about cash flow. These findings are consistent with Brown et al. [1985] in that the forecast revisions provide incremental explanatory power relative to the forecast error. However, unlike Brown et al., we find that forecast error includes information not contained in the forecast revisions. It is possible that this second finding is due to the

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[13] This calculation is only approximate. As French and Roll [1986] show empirically, the variance of stock returns does not increase linearly with the length of the observation interval.

[14] Deflating by the square root of the number of days in the event interval, n, is consistent with the error variance model: $\epsilon_i^2=n_i{*}\sigma^2$. Deflating by an estimate of the standard deviation of the market model residual is consistent with the general error variance model: $\epsilon_i^2=\sigma_i^2$. Note that σ_i^2 is estimated using monthly data, the event interval is not strictly a month.

TABLE 2

RESULTS FOR REGRESSIONS OF ABNORMAL RETURNS ON FORECAST ERRORS AND FORECAST REVISIONS
(1984–1986)
(n=2,777)

Model: $AR_{it}=\alpha_0+\alpha_1 FE_{it}+\alpha_2 FRQ_{it}+\alpha_3 FRY_{it}+\epsilon_{it}$

Panel A. Undeflated Model:

	Independent	*Variables*					
	INTERCEPT	FE	FRQ	FRY	R^2	F-*statistic*	*Prob*>F
Est. Coef.	−0.009	0.047	0.267	0.400	.0295	28.14	0.0001
t-statistic	−7.527	4.685	2.351	5.159			
Prob>$\|t\|$	0.000	0.000	0.018	0.000			

Panel B. Square Root Number of Days Deflator Model:

	Independent	*Variables*					
	INTERCEPT	FE	FRQ	FRY	R^2	F-*statistic*	*Prob*>F
Est. Coef.	−0.002	0.027	0.259	0.177	.0100	9.37	0.0001
t-statistic	−6.150	1.942	2.899	2.573			
Prob>$\|t\|$	0.000	0.052	0.004	0.010			

Panel C. Standard Deviation of Residuals Deflator Model:

	Independent	*Variables*					
	INTERCEPT	FE	FRQ	FRY	R^2	F-*statistic*	*Prob*>F
Est. Coef.	−0.143	0.030	0.359	0.535	.0230	21.75	0.0001
t-statistic	−7.721	2.004	3.076	5.313			
Prob>$\|t\|$	0.000	0.045	0.002	0.000			

Panel D. Combined Deflator Model:

	Independent	*Variables*					
	INTERCEPT	FE	FRQ	FRY	R^2	F-*statistic*	*Prob*>F
Est. Coef.	−0.036	0.007	0.337	0.270	.0102	9.48	0.0001
t-statistic	−6.724	0.402	3.596	2.877			
Prob>$\|t\|$	0.000	0.687	0.000	0.004			

greater power using a shorter observation interval.[15]

Another reason why the results for the forecast error may differ from Brown et al. [1985] is that their study used annual data based on fourth quarter announcements. If fourth quarter announcements are somehow different, or more informative, than the interim announce-

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[15] In Brown et al. [1985], the observation interval is eight to ten months long, whereas in this study the observation interval averages 15 trading days.

TABLE 3

RESULTS FOR REGRESSIONS OF ABNORMAL RETURNS ON FORECAST ERRORS AND FORECAST REVISIONS ALLOWING FOR DIFFERENT SLOPES IN THE FOURTH QUARTER

(1984–1986)

$(n=2{,}777)$

Model: $AR_{it}=\alpha_0+\alpha_1 FE_{it}+\alpha_2 FRQ_{it}+\alpha_3 FRY_{it}+\alpha_4 DFE_{it}+\alpha_5 DFRQ_{it}+\alpha_6 DFRY_{it}+\epsilon_{it}$

Indep. Vars.	*Est. Coef.*	*t-statistic*	*Prob>* $\lvert t \rvert$
INTERCEPT	−0.009	−7.136	0.000
FE	−0.003	−0.145	0.884
FRQ	0.245	2.084	0.037
FRY	0.162	1.670	0.095
DFE[1]	0.079	2.940	0.003
DFRQ	−0.387	−0.921	0.357
DFRY	1.272	6.648	0.000
R^2	.0543		
F-statistic	26.52		
Prob>*F*	0.0001		

[1] $DFE=D\times FE$, with $D=1$ if $t=(2$ or $6)$ (the fourth quarter of 1984 and 1985), and $D=0$ otherwise.
$DFRQ=D\times FRQ$, with $D=1$ if $t=(2$ or $6)$ (the fourth quarter of 1984 and 1985), and $D=0$ otherwise.
$DFRY=D\times FRY$, with $D=1$ if $t=(2$ or $6)$ (the fourth quarter of 1984 and 1985), and $D=0$ otherwise.

ments, this could explain part of the difference. To investigate this possibility, equation (6) is reestimated using indicator variables to permit the coefficients of the regressors, *FE*, *FRQ*, and *FRY*, to take on different values in the fourth quarter, as shown in equation (7):

$$\begin{aligned} AR_{it}=\alpha_0+\alpha_1{*}FE_{it} \\ +\alpha_2{*}FRQ_{it}+\alpha_3{*}FRY_{it} \\ +\alpha_4{*}DFE_{it}+\alpha_5{*}DFRQ_{it} \\ +\alpha_6{*}DFRY_{it}+\epsilon_{it}, \end{aligned} \qquad (7)$$

where the *D* prefix represents a multiplicative indicator variable that takes on a value of one in the fourth quarter and zero otherwise.

The estimation results for the undeflated version of equation (7), reported in Table 3, clearly support the view that the fourth quarter is unique.[16] Most strikingly, the coefficient of *DFRY* has a *t*-statistic of 6.65. This is consistent with the interpretation that analysts wait until the annual announcement before making major revisions in their annual predictions. In addition, the quarter ahead forecast revision provides no incremental explanatory power in the fourth quarter.[17] Finally, the indicator regression reveals that the forecast error is significantly different from zero only in the fourth quarter.[18] It appears, therefore, that for interim announcements most of the information of interest to investors is contained in the quarter ahead revision. At year end, however, the forecast error and the year ahead forecast revision are paramount. This pattern can be explained by a combination of two factors. First, analysts may wait until year end to make significant revisions in their year ahead forecast. Second, the year end announcement may be more informative, so that the forecast error is of greater interest to investors. This could be due to the fact that only the year end statements are audited and the fourth quarter results may contain corrections of earnings previously reported in prior quarters [Kinney and McDaniel, 1989].

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[16] The results for the deflated models are qualitatively the same and are available upon request.

[17] To examine the incremental explanatory power of *FRQ* in the fourth quarter, we tested whether the sum of the coefficients of *FRQ* and *DFRQ* is significantly different from zero. The *F*-statistic for the test of the hypothesis that the sum equals zero is 0.012 with a significance level of 0.72.

[18] The *F*-statistic for the test of the hypothesis that the sum of the coefficients for *FE* and *DFE* equals zero is 30.4 with a significance level of 0.0001.

The results are only partially consistent with the findings of Brown et al. [1985]. Though the fourth quarter findings underscore the importance of the year ahead revision, the current forecast error is also significant.

V. INTERPRETATION OF FINDINGS AND CONCLUSION

The DCF model predicts that stock price changes should be correlated with revisions in the forecasts for future earnings as well as the current earnings forecast error. While numerous empirical accounting studies document the link between earnings innovations and stock prices, the extent to which this link is due to new information about current earnings compared with revisions in forecasts of future earnings has only recently been investigated. Easton and Zmijewski [1987] and Kormendi and Lipe [1987] both present evidence which shows that the reaction of stock prices to an earnings announcement depends on the extent to which the earnings innovation is perceived to be permanent. Using annual data, Brown et al. [1985] conclude that all of the information contained in the current annual earnings innovation is contained in the revision of next year's earnings forecast, but not vice versa.

The results reported here, which are based on quarterly data, are consistent predictions of the discounted cash flow model. We find that when the revisions in the forecast for next quarter's and next year's earnings are included in a residual return regression model, along with the current forecast error, all three variables have significant explanatory power. The results, however, are not identical across quarters. For the interim announcements, the forecast error's coefficient is insignificant, the coefficient of the year ahead forecast revision is marginally significant, and most of the explanatory power is provided by the quarter ahead forecast revision. For the fourth quarter, on the other hand, the coefficient of the quarter ahead forecast revision is insignificant, the coefficient of the forecast error is significant, and there is a sharp rise in the explanatory power of the regression due to the year ahead forecast revision.

These results are consistent with the following interpretation. For interim announcements, analysts focus their attention on forecasting quarter ahead earnings. Accordingly, most of the information of interest to investors is provided by quarter ahead forecast revisions, rather than forecast errors or year ahead forecast revisions. However, for audited annual announcements, the situation is different. First, the forecast error—rather than the quarter ahead forecast revision—provides significant explanatory power. Second, the year ahead forecast revision, which had only marginal impact for interim announcements, provides most of the explanatory power. This suggests that audited annual announcements are uniquely informative, and that because of this, analysts wait until year end earnings are announced to update their annual forecasts.

The finding that forecast revisions explain most of the variance in the stock price associated with the announcement of earnings has potential implications for prior accounting research, such as Brown et al. [1987]. Recall that Brown et al. find that multiple forecast error terms are significant in explaining stock price reactions to quarterly earnings announcements. They explain this result as an artifact of measurement error in each of the forecasts. In light of the findings reported here, however, it is possible that their result would disappear if analyst forecast revisions, rather than the forecast error, were used as explanatory variables.

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NOTES

Auditor Reputation and the Pricing of Initial Public Offerings

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ABSTRACT: It is hypothesized that an inverse relation exists between the reputation of the auditor of an initial public offering and the initial return earned by an investor. Specifically, clients that hire more reputable CPA firms should exhibit lower initial returns than clients that choose to hire CPA firms with less reputation capital at stake. Two proxies for auditor reputation are used to test this hypothesis. The first reputation proxy uses indicator variables for auditor size. Results indicate that the widely used Big Eight/non-Big Eight classification may measure CPA firm reputation capital with error particularly for the smaller Big Eight and larger non-Big Eight firms. A second reputation proxy is developed by regressing compensation paid to the auditing firms on measures of marginal cost of performing the audit. The initial return to the IPO investors is regressed on the residual from the compensation regression to provide evidence of the reputation hypothesis. Results indicate that clients that pay a premium for their registration audit exhibit lower initial returns for their investors. Thus, the results of both tests provide support for the hypothesized inverse relation between auditor reputation and initial public offering initial return.

A COMPANY "going public" must provide a prospectus that includes a description of its present and future operations and *audited* financial statements. Since privately held firms face limited disclosure requirements, the market usually possesses less publicly available data from them than from comparable publicly traded firms. This difference in regulatory environment provides a potentially fruitful setting in which to consider the role of the public accountant.

Since switching auditor just prior to going public is widely alleged, it is natural to investigate management's motivation for such a change (see "Small

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CPA Concern Sues an Underwriter Over Loss of Client," *The Wall Street Journal* [July 18, 1983, p. 1]). Carpenter and Strawser [1971] describe the results of a survey of AICPA members concerning the displacement issue as follows:

> Almost universally, the reason expressed [for the change in auditors] was that the underwriters informed the client that a "nationally known firm" was necessary to sell their offering at the highest possible price [p. 55].

This widely held view suggests that the employment of a "nationally known" audit firm will increase the price (reduce the initial return) received by the initial public offering (IPO) client.

This paper presents and tests the hypothesis that audit firm reputation is inversely related to the initial return earned by an IPO investor. The evidence is consistent with an inverse relation between auditor reputation and the initial return to the IPO investor. First, tests of linear restrictions of indicator variable coefficients are interpreted within the traditional Big Eight/non-Big Eight framework to suggest a negative relation between auditor reputation and initial return. A second partition (Largest-Five, Middle-Six, and Smallest-Nine audit firms) is introduced to provide evidence that *ad hoc* classification schemes may only crudely separate the set of audit firms by reputation capital. In particular, it appears that smaller Big Eight and larger non-Big Eight firms exhibit similar reputations in the IPO market. To test the reputation hypothesis without relying on an *ad hoc* classification, reputation capital is inferred from the observation of auditor compensation. These tests use a measure of the residual compensation paid to the IPO auditing firm and provide the first direct evidence of the hypothesized reputation relation.

Section I draws from the previous empirical and theoretical literature to suggest testable assertions relating auditor reputation and the initial return to an IPO investor. Section II describes the data used in the empirical tests and provides a number of descriptive statistics. Results of regression tests of the reputation hypothesis are presented in Section III and, finally, Section IV concludes with a summary.

I. UNDERPRICING AND THE ROLE OF THE AUDITING FIRM

Previous studies of the IPO market have focused on an empirical phenomenon that has been described as "underpricing" of the firm's equity securities.[1,2] The term "underpricing" is used to describe the difference between the offering price and the market clearing price at issuance. Numerous empirical papers have demonstrated this persistent underpricing of equity securities [Ibbotson, 1975; Ibbotson and Jaffee, 1975; and Ritter, 1984].

Various asymmetric information models have been proposed to explain this phenomenon. In one model, the investment banker is "better informed" than the issuing firm as to the demand for the issuing firm's securities [Baron, 1982]. In another, two classes of IPO investors, informed and uninformed, are assumed to exist [Rock, 1982 and 1986; Beatty and Ritter, 1986]. In each of these models, the investment banker or the uninformed investors face uncertainty concerning the IPO firm value. The precision

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[1] For a review of the literature on the IPO market, see Smith [1986].

[2] Underpricing translates directly into the initial return, defined as the return earned by an investor buying at the offering price and selling at the first-day closing price. These terms will be used interchangeably in the remainder of this paper.

of the distribution of uncertainty of firm value has been described as *ex ante* uncertainty [Beatty and Ritter, 1986]. Both of these models imply that there is a positive relation between *ex ante* uncertainty and the underpricing of the IPO.

Some investigators have argued in the agency literature that auditing services are demanded to reduce costs arising from conflicts of interests between owners and managers [Jensen and Meckling, 1976; Watts and Zimmerman, 1983]. Since the nature and extent of agency costs vary across firms that attempt to minimize these costs, the auditing services demanded will be heterogeneous. This heterogeneity may lead CPA firms to differentiate themselves on the basis of investment in reputation capital to facilitate the attestation function [Kinney, 1988].

Simunic and Stein [1987] suggest that auditor product differentiation on the dimensions of control, credibility, and product line motivates management's auditor choice in the IPO market. They conclude that the form of the underwriter agreement, the proportion of common stocks held by outsiders after the IPO, and a measure of uncertainty are related to the choice of auditing firm. Beatty [1989] provides evidence consistent with Simunic and Stein [1987] that larger and less risky IPO clients tend to hire Big Eight audit firms. As in this study, preliminary evidence from indicator variable regressions suggested that auditor reputation might be related to underpricing.

Titman and Trueman [1986] present a signalling model that results in auditor quality providing information useful to investors in assessing the value of the IPO firm. Two features of their model lead to signalling of the IPO firm's value. First, high quality auditors (or investment bankers) are those individuals with a comparative advantage in establishing the reported information variable that is related to the firm value. Second, the firm is required to pay a "price premium" for this higher quality audit.[3] These two expected costs of hiring the high quality auditor exceed the expected benefits of misclassification for the low firm value IPOs. This cost-benefit relation leads the entrepreneur to choose an audit firm that "signals" firm value to the market. Although this model does not consider the underpricing phenomenon, a similar signalling environment is used here to hypothesize a relation between auditor reputation and the underpricing of an IPO.

The firm's existing owners have an incentive to minimize underpricing since it transfers wealth from them to the new investors.[4] The literature suggests a direct relation between *ex ante* uncertainty and underpricing of the IPO [Baron, 1982; Rock, 1982 and 1986; and Beatty and Ritter, 1986]. All firms (existing owners) have an incentive to disclose "low" *ex ante* uncertainty, giving rise to the classic "lemons" problem [Akerlof, 1970]. However, firms whose *ex ante* uncertainty is in fact "high" have a greater incentive to misrepresent.

One means of reducing the misrepresentation problem is to hire an agent who can credibly attest to the assertions contained in the audited financial statements [Kinney, 1988]. Auditors have an incentive to investigate and report deviations in application of accounting principles since their reputation capital is reduced by *ex post* revelation of errors or misstatements [Palmrose, 1988]. Since auditing firms that have invested more in reputation capital have greater incentives to reduce application errors, the information disclosed in the accounting reports audited by these firms will be more precise, *ceteris paribus*. This reduction in measurement error will allow uninformed investors to estimate more precisely the distribution of firm value. Since the high reputation auditor attests to a report that reduces uninformed investors' *ex ante* uncertainty, this comparative advantage will be priced in the market for audit services. Value-maximizing owners of the IPO firm will choose the auditing firm with reputation capital that equates the marginal benefit of less underpricing with the marginal cost of a higher quality audit.

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[3] Klein and Leffler [1981] present a model of product quality variation that requires a price premium for the high quality product to assure its production.

[4] The "amount of money left on the table," the difference between the offering price and the market clearing price multiplied by the number of shares in the IPO, is a measure of the wealth transferred from existing owners to new investors.

The preceding arguments have two implications. First, the initial return of an IPO will be inversely related to the reputation of the auditing firm attesting to the accounting reports. Second, the premium paid for a high quality auditing firm will be inversely related to the initial return of the IPO client.

II. Data and Descriptive Statistics

The data used in the empirical tests are drawn from the population of 2,567 IPOs from 1975-1984. The final sample was reduced to 2,215.[5] The main data sources for the variables are the IPO's registration statement and amendments and *Going Public: The IPO Reporter* (published weekly).

The initial return for a firm going public is defined as the first day gross return to an investor who acquires a share and sells at the closing bid price on the first day of public trading.[6] For 1975-1984, the average initial return is 22.1 percent.

A test of the compensation premium implication of the reputation hypothesis requires a measure of the fee paid to the auditor. A proxy for this fee that is available for the entire sample is the cash compensation. This measure includes auditing, printing, legal, and other miscellaneous fees (such as "Blue Sky" registration fees). The average cash compensation for 1975-1984 is $218,929.

Aftermarket standard deviation is presented as an *ex post* proxy for *ex ante* uncertainty to assess cross-sectional differences in *ex ante* uncertainty for the sample. The aftermarket standard deviation is computed as the standard deviation of returns for the first 20 trading days excluding the initial return using bid prices. This measure is available for only 1,807 firms since the remaining firms were not listed on NASDAQ or another exchange. The average aftermarket standard deviation in the sample is .033.

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[5] Each IPO included in the final sample had initial return, age, type of offering, gross proceeds, sales, book value of equity, and cash expenses (auditor fees, legal fees, and miscellaneous fees) available in their S1 or S18 registration statement or other publicly available sources. Regulation A registrations, small public offerings, were not included in this study due to data limitations. An initial public offering that is registered under Regulation A is significantly smaller than the average offering in this sample. Prior to 1978, the maximum amount raised in a Regulation A offer was $500,000. After 1978, the limit was raised to $1,500,000. Missing registration statements and the lack of an observable bid price (firms trading in the "pink sheets") account for the reduction in observations from 2,567 to 2,215.

[6] The first day closing price is not always available. The closing bid price is available for 1,499 of the IPOs within one day of the closing date. An additional 412 bid prices are available within one week of the closing date. Bid prices are available for 236 IPOs within a month of the closing date of the IPO. The remaining 68 firms' bid price is obtained within one year of the offering. For IPOs listed on NASDAQ (82.6 percent), the first available closing bid price from the *Daily Stock Price Record* has been used to construct the initial return. Finally, 12.4 percent of the IPOs in this study were not listed on NASDAQ. These firms required the use of other data sources to estimate the initial returns for these securities [Ritter, 1984].

Table 1 presents selected descriptive statistics for audit firm IPO clients. The identified firms audited at least ten IPOs during the 1975–1984 period and the Big Eight firms audited 58 percent of the IPO clients.[7] The statistical tests suggest a number of differences in IPO clients by Big Eight/non-Big Eight distinction. First, larger clients generally are audited by Big Eight firms.[8] However, the traditional Big Eight/non-Big Eight distinction does not completely capture differences in client size. In particular, Peat Marwick, Touche Ross, and Coopers & Lybrand clients exhibit similar magnitudes of median sales revenue as Laventhol Horwath, Seidman & Seidman, and Alexander Grant clients.

Panels A and B of Table 1 suggest that auditor compensation is larger for Big Eight audit firms relative to competing non-Big Eight firms.[9] Aftermarket standard deviation is smaller for Big Eight compared to non-Big Eight clients. Finally, initial return is significantly smaller for Big Eight compared to non-Big Eight clients. These differences in risk and return suggest that clients of particular subsets of CPA firms may not be homogeneous with respect to *ex ante* uncertainty.

III. UNDERPRICING, *Ex Ante* UNCERTAINTY, AND AUDITING FIRM REPUTATION

In this section, an indicator variable approach is used to test for a relation between auditing firm reputation and the underpricing of initial public offerings. The regression model controls for *ex ante* uncertainty (client age, type of underwriting contract, and percentage ownership offered in the IPO), industry affiliation (oil and gas indicator variable), and other reputation effects (underwriter indicator variable). The marginal impact of a particular CPA firm is tested with an indicator variable for each of the 20 CPA firms auditing more than ten IPOs in the 1975–1984 period, and the reputation hypothesis is evaluated by testing linear restrictions on the estimated coefficients of the Big Eight/non-Big Eight indicator variables.[10] Finally, sensitivity of the results to the traditional Big Eight/non-Big Eight grouping is considered by alternative groupings based on client size.

The estimated model is:

$$\begin{aligned}\text{Initial Return}_i &= a + b\,(\text{Age of Client}_i)\\ &\quad + c\,(\text{Type of Underwriting Contract}_i)\\ &\quad + d\,(\text{Percentage of Ownership Offered}_i)\\ &\quad + e\,(\text{Oil \& Gas Indicator}_i)\\ &\quad + f\,(\text{Underwriter Reputation Indicator}_i)\\ &\quad + \underline{r}\,(\text{Auditing Firm (1-20) Indicator}_i). \qquad (1)\end{aligned}$$

Indicator Variable Regression

Client age is used as a control variable in the regression model (panel A of Table 2) since a longer operating history may provide market participants with in-

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[7] This percentage is consistent with the 59 percent, 68 percent, and 62 percent concentration ratios for publicly traded clients reported in Simunic [1980], Palmrose [1986], and Francis and Simon [1987].

[8] Book value of equity, age, gross proceeds, and net proceeds provide additional support for the notion that larger clients tend to be audited by Big Eight firms [Beatty, 1989].

[9] For a subsample of 1,276 IPOs (1981–1984), auditor fees for preparation of the registration document were collected from Part II of the registration statement. Typically, this involves obtaining amendments to the registration statement since the auditing fees are rarely submitted with the final prospectus. The correlation between reported accounting fees (Part 2 of the prospectus) and cash compensation is .771, suggesting that the cash compensation (available for the entire sample) provides a reasonable proxy for the auditor's compensation for reviewing the prospectus.

[10] Testing linear restrictions on estimated coefficients is described in Judge et al. [1980, pp. 61–62].

TABLE 1

DESCRIPTIVE STATISTICS (1975–1984)
CLIENT SIZE, RETURN, AND *EX ANTE* UNCERTAINTY MEASURES
MEDIAN SALES REVENUE, AUDITOR COMPENSATION, INITIAL RETURN,
AND STANDARD DEVIATION BY AUDITOR

Auditor	*Sales (000's)*	*Cash Compensation*[1] *(000's)*	*Initial Return*	*Aftermarket Standard Deviation*[2]	*Number of Clients*[3] (N_1, N_2)
Panel A. Big Eight Audit Firm Clients:					
Ernst & Whinney (EW)	$10,423	$219	.025	.027	141, 125
Deloitte Haskins & Sells (DHS)	6,437	241	.023	.034	122, 102
Price Waterhouse (PW)	5,939	240	.021	.030	141, 128
Arthur Young & Co. (AY)	6,404	252	.038	.031	163, 149
Arthur Andersen & Co. (AA)	5,695	230	.053	.034	225, 207
Peat, Marwick, Mitchell & Co. (PMM)	4,110	210	.028	.026	191, 171
Touche Ross & Co. (TR)	3,220	199	.050	.030	153, 139
Coopers & Lybrand (CL)	2,246	185	.018	.033	146, 133
Big Eight	4,926	220	.031	.031	1282, 1154
Panel B. Non-Big Eight Audit Firm Clients:					
Laventhol Horwath (LH)	$ 4,321	$180	.050	.034	59, 49
Seidman & Seidman (SS)	3,668	175	.042	.037	27, 25
Alexander Grant (AG)	2,300	175	.042	.035	55, 45
Main Hurdman (MH)	1,755	188	.033	.033	78, 67
Mann Judd Landau (MJL)	1,631	112	.044	.033	16, 12
McGladrey Hendrickson (MHD)	778	108	.250	.034	18, 16
Oppenheim, Appel (OAD)	307	147	.150	.040	10, 7
All Others	87	90	.068	.040	577, 372
Fox, Fox & Co. (FOX)	96	85	.125	.038	37, 33
Hein & Sikora (HS)	6	75	.375	.062	13, 12
Newman & Co. (NEW)	3	58	.188	.037	12, 10
Lehman, Butterwick (LB)	1	56	.125	.034	10, 4
Roth (R)	0	50	.600	.073	21, 1
Non-Big Eight	154	101	.067	.038	933, 653

Panel C. Non-Parametric Statistical Comparisons of Big Eight and Non-Big Eight Clients:

Statistic	*Sales*	*Cash Compensation*	*Initial Return*	*Aftermarket Standard Deviation*
Big Eight, non-Big Eight Comparison				
Mann-Whitney *U*-Test	−15.390	−15.452	2.435	−6.100
(Probability)	.000	.000	.015	.000
Median Test Chi-Square	159.608	191.257	7.610	27.374
(Probability)	.000	.000	.006	.000

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[1] Cash Compensation = Auditor fees + Legal fees + Printing fees + Miscellaneous fees.

[2] Aftermarket Standard Deviation = standard deviation of return 2 through 21.

[3] Panels A and B present medians for selected variables by individual audit firm and Big Eight/non-Big Eight distinction. In the final column of panels A and B N_1 = the number of IPO clients and N_2 = the number of clients available to compute aftermarket standard deviation. Panel C presents the Mann-Whitney *U*-test and Median test for differences in the selected variables by Big Eight/non-Big Eight.

TABLE 2

INDICATOR REGRESSION RESULTS WITH DEPENDENT VARIABLE = INITIAL RETURN AND INDEPENDENT VARIABLES = AGE, TYPE OF OFFERING, PERCENT RETAINED BY OWNERS, OIL AND GAS, UNDERWRITER, AND AUDITING FIRM INDICATORS

1975–1984

(n=2,215)

$$\begin{aligned}\text{Initial Return}_i = a &+ b\,(\text{Age of Client}_i) + c\,(\text{Type of Underwriting Contract}_i)\\ &+ d\,(\text{Percentage of Ownership Offered}_i)\\ &+ e\,(\text{Oil and Gas Indicator}_i)\\ &+ f\,(\text{Underwriter Reputation Indicator}_i)\\ &+ \underline{r}\,(\text{Audit Firm (1-20) Indicator}_i)\end{aligned}$$

Panel A. Control Variable Coefficient Estimates:

Constant	*Age*	*Type of Offering (0, 1)*	*Percent by Owners*	*Oil and Gas Indicator (0, 1)*	*Underwriter Indicator (0, 1)*
.29829	−.00182	−.21432	.15384	.13985	−.06997
(.03830)	(.00095)	(.02720)	(.07313)	(.03720)	(.03153)
t=7.79	t=−1.91	t=−7.88	t=2.10	t=3.76	t=−2.22

Panel B. Indicator Variable Coefficient Estimates:

Big Eight Firms

AA	*AY*	*CL*	*DHS*	*EW*	*PM*	*PW*	*TR*
.01113	.02305	.03156	−.01340	.01514	.06304	−.04721	.02402
(.04143)	(.04647)	(.04812)	(.05181)	(.04936)	(.04367)	(.04902)	(.04725)
t=.27	t=.50	t=.66	t=−.26	t=.31	t=1.44	t=−.96	t=.43

Non-Big Eight Firms

AG	*FOX*	*HS*	*LB*	*LH*	*MH*	*MHD*	*MJL*	*NEW*	*OAD*	*R*	*SS*
.02590	.16427	.41680	−.27260	−.00981	.02303	.62291	−.03848	−.02625	.00283	.73832	−.05193
(.07251)	(.08684)	(.14364)	(.16328)	(.07034)	(.06219)	(.12250)	(.12991)	(.15094)	(.16308)	(.11443)	(.10126)
t=.36	t=1.89	t=2.90	t=−1.67	t=−.14	t=.37	t=5.09	t=−.30	t=−.18	t=.02	t=6.45	t=−.51

R^2=.116 F-statistic=11.523*

Table 2—*Continued*

Panel C. Tests of Hypothesis that Linear Combinations of Audit Firm Coefficients Equal Zero—$\underline{Lr}=0$**:

	F-*statistic*	*Probability*
Big Eight—non-Big Eight Comparisons		
Sum of the Big Eight Coefficients Equal Zero	$F_{1,2189}=.222$	.638
Sum of the non-Big Eight Coefficients Equal Zero	$F_{1,2189}=10.897$	.001
Big Eight Minus non-Big Eight Coefficients Equal Zero	$F_{1,2189}=11.581$	.001
Largest-Five, Middle-Six, and Smallest-Nine Comparisons Classification by Client Sales Revenue (Table 1)		
Sum of the Largest-Five Coefficients Equal Zero	$F_{1,2189}=.006$	.940
Sum of the Middle-Six Coefficients Equal Zero	$F_{1,2189}=.146$	.702
Sum of the Smallest-Nine Coefficients Equal Zero	$F_{1,2189}=14.318$	.001
Largest-Five Minus Middle-Six Coefficients Equal Zero	$F_{1,2189}=.247$	.619
Middle-Six Minus Smallest-Nine Coefficients Equal Zero	$F_{1,2189}=13.378$	.001
Largest-Five Minus Smallest-Nine Coefficients Equal Zero	$F_{1,2189}=16.053$	.001

Note: Standard errors are in parentheses. The sample is composed of 2,215 SEC-registered initial public offerings from 1975–1984. The mean of the initial return is 22.1 percent. The mean of the age of the clients is 7.359 years. There were 1,484 firm commitment offerings in the 2,215 IPOs. The average percentage offered by owners is .338. There were 233 oil and gas firms going public from 1975–1984. Major bracket underwriters were associated as lead underwriter or co-managing an IPO in 390 cases out of the 2,215. The remaining variables (AA through SS) are indicator variables (0, 1) for firms listed in Table 1. The t-statistics are presented below each coefficient in panels A and B.

* Significant at the .0001 level.

** $\underline{L}$ is a 1 by 20 vector with 0's, 1's, or −1's to create the appropriate restriction of interest. $\underline{r}$ is a 20 by 1 vector of the estimated indicator variable coefficients.

formation concerning managerial production-investment decisions. This additional information may allow investors to marginally reduce their estimate of *ex ante* uncertainty. The estimated coefficient is negative and statistically significant at the .06 probability level. This result suggests that larger client age indicates lower *ex ante* uncertainty.[11]

The second control variable is the type of underwriting contract, firm commitment or best efforts.[12] The type of underwriter agreement may provide a proxy for the underwriter's assessment of the price uncertainty for an IPO. The type of offering (best efforts=0, firm commitment=1) is inversely related to the initial return for the IPO at the .0001 probability level. This result is consistent with lower *ex ante* uncertainty for firm commitment underwriting contracts.

Research by Leland and Pyle [1977] and Downes and Heinkel [1982] suggests that the percent ownership retained by insiders signals private information possessed by the owner/manager to investors. The percentage offered by owners in the IPO is positively related to the initial return at the .04 level consistent with Leland and Pyle's model.

Table 2 reports two final indicator variable coefficients for each regression. The oil and gas indicator variable (oil and gas=1, others=0) is considered since Ritter [1984] observes a significant association between industry affiliation and initial return during the "Hot Issue" market of 1980. Panel A of Table 2 shows that, as in the previous study, oil and gas IPOs exhibit significant positive initial returns.[13] The underwriter indicator variable controls for underwriter reputation. Beatty and Ritter [1986] argue that underwriter reputation is related to the level of underpricing of an initial public offering. This study uses an indicator variable (top 18=1, others=0) for the 18 largest underwriters by total capital that are members of the Securities Industry Association.[14] The underwriter indicator variable regression coefficient is significant at the .03 level.

Panel B of Table 2 summarizes the indicator variables for the 20 identified CPA firms. Four CPA firm indicator variables are positive and significant at the .05 level. They are Fox, Fox & Co.; Hein & Sikora; McGladrey, Hendrickson & Co.; and Allen Roth. Clients of these four non-Big Eight firms exhibited significantly higher initial returns than those of other auditors.

Two sets of tests of linear combinations of the coefficients of the CPA firm indicator variables are presented in panel C of Table 2. First, the traditional Big Eight/non-Big Eight dichotomy is investigated. The second is partitioned based upon the largest-five, middle-six, and smallest-nine audit firm median client sales revenue.

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[11] It has been suggested in Manegold [1987] that distinguishing between startup and operating firms may control for client risk. In unreported regressions, a startup/operating indicator variable replaced the age variable. The results were consistent with the reported results and the startup/operating variable was not significant.

[12] A "firm commitment" underwriting agreement specifies that the underwriter purchases the shares from the client to be offered for resale. In a "best efforts" underwriting arrangement, an underwriter agrees to place as many securities as a "best effort" permits.

[13] Elimination of the oil and gas firms from the sample does not alter any of the inferences of the tests. Also, an indicator variable for "high tech" firm was considered with insignificant results.

[14] The Securities Industry Association is an organization that lobbies for members' interests. Membership is restricted to "reputable" securities industry members. As with other voluntary organizations, the definition of reputable member of the securities industry is not well-defined. The SIA has summarized the capital ranks for their membership in an annual publication, *Securities Industry Yearbook*. The top 18 underwriters have been assigned to the "highly" reputable category for purposes of the underwriter indicator variable. The top 18 underwriters capital as of January 1, 1985 exceeded $200,000,000. Alternative classifications of underwriter reputation by capital rank did not appreciably change the qualitative results.

Panel C reports tests of the linear restrictions on the coefficients of the Big Eight and non-Big Eight indicator variables. The results indicate significant differences in initial return based upon the Big Eight/non-Big Eight distinction. The trichotomous partition tests indicate that the middle-six CPA firms are more similar to the largest-five CPA firms than to the smallest-nine CPA firms. This sensitivity analysis suggests that the traditional Big Eight/non-Big Eight distinction may measure reputation with error since the smallest Big Eight and largest non-Big Eight appear to exhibit substantial similarities. Finally, the correlation matrix (not reported) indicates that correlations across covariates are small (all less than .32) and, thus, multicollinearity is not expected to affect the results.

These results provide evidence of a relation between auditor classification and the initial return. However, interpreting these results as consistent with a relation between reputation and initial return requires the maintained hypothesis that a particular partition, such as the traditional Big Eight/non-Big Eight distinction, captures differences in firm reputation capital. Since choice of an appropriate partition is rather *ad hoc*, an alternative approach that does not rely on arbitrary classifications to test the reputation hypothesis is considered in the next subsection.

Two-Stage Regression Approach

There are two salient features of the reputation hypothesis that suggest the use of an omitted variables technique to establish a proxy for reputation. First, a firm's reputation capital is unobservable. Second, the reputation hypothesis implies that the IPO client is charged a premium for employing the auditor's reputation capital. A two-stage approach estimates an auditor compensation regression with observable independent variables. Then the residuals from the first regression are used as a proxy for the unobservable variable, reputation capital. The relation between the residual of the estimated auditor compensation regression and the unobservable reputation variable is illustrated and then the "omitted variables" formulation is applied to test the reputation hypothesis.

A compensation regression model that does not include the omitted variable can be estimated as follows:

$$\begin{aligned}\text{Cash Comp}_i &= a_1 + b_1\,(\text{Gross Proceeds}_i)\\ &\quad + c_1\,(\text{Sales}_i)\\ &\quad + d_1\,(\text{Equity}_i) + u_i.^{15}\end{aligned} \tag{2}$$

However, the reputation hypothesis asserts that the correct specification of the regression equation is:

$$\begin{aligned}\text{Cash Comp}_i &= a_1^* + b_1^*\,(\text{Gross Proceeds}_i)\\ &\quad + c_1^*\,(\text{Sales}_i)\\ &\quad + d_1^*\,(\text{Equity}_i)\\ &\quad + e_1^*\,(R_i) + v_i.\end{aligned} \tag{3}$$

If one assumes that the omitted variable, R (a firm's reputation capital), is uncorrelated with the other independent variables, the sign of the correlation between the estimated residual and the omitted variable is directly related to the sign of e_1^*. Formally, this correlation is:

$$\begin{aligned}\text{corr}(u_i, R_i) &= e_1^*\, E\{(R_i - E(R))^2\}\\ &\quad /(\text{std. dev}_u)(\text{std. dev}_R).\end{aligned} \tag{4}$$

Since we assume that the IPO client is

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[15] The chosen independent variables in the compensation regression are intended to proxy for the marginal cost of the audit. Omitted variables analysis is discussed in Kmenta [1986], pp. 392–395.

charged a premium for the auditor's reputation, the sign of the omitted variable coefficient, e_i^*, is positive. Thus, u_i from equation (2) provides a measure that is positively correlated with the variable of interest. The second-stage regression relates the initial return to the control variables and the residual from the compensation regression as follows:

$$\begin{aligned}\text{Initial Return}_i &= a_2 + b_2\,(\text{Age of Client}_i)\\ &\quad + c_2\,(\text{Type of Underwriting Contract}_i)\\ &\quad + d_2\,(\text{Percentage of Ownership Offered}_i)\\ &\quad + e_2\,(\text{Oil \& Gas Indicator}_i)\\ &\quad + f_2\,(\text{Underwriter Reputation Indicator}_i)\\ &\quad + r_2\,(u_i). \qquad (5)\end{aligned}$$

A negative coefficient on the unexpected cash compensation, u_i, is consistent with the reputation hypothesis.

Table 3 presents results of the two-stage least squares approach used to assesss the relation between audit firm reputation and initial return. In the first stage, auditor compensation is regressed on three size variables, gross proceeds, sales revenue, and book value of equity. The residual from the regression should be interpreted as the price paid to a particular audit firm above or below the average price paid for auditor reputation. The average price paid for reputation is imbedded in the constant term in equation (2). From the analysis in Section II, as the price paid for the CPA firm's reputation capital is increased, less "money is left on the table" in the form of underpricing, which suggests an inverse relation with initial return. The reputation hypothesis predicts that the coefficient on the residual auditor compensation variable will be negative in the second stage regression.

Sales revenue, book value of equity, and gross proceeds provide proxies for the size variables that have been found by previous studies to be related to auditor compensation. Although these three measures are different from the independent variables suggested by previous researchers of auditor compensation [Simunic, 1980; Mayer et al., 1985; and Francis and Simon, 1987], they provide similar control for the marginal cost of performing an audit. For instance, increased sales revenue can be expected to be directly related to increased inventories and accounts receivable. In addition, one would expect that larger firms (measured by book value of equity and gross proceeds) would more likely exhibit more consolidated subsidiaries, two-digit SIC codes, and foreign operations. It should be noted that the R-squared for equation (2) of Table 3 is .18, which is comparable to Simunic's less-than-$125,000,000 regression results of .28. However, the results of this analysis rest on the assumption that any missing variables are uncorrelated with the initial return of the IPO.

The coefficients for gross proceeds and sales revenue in panel A of Table 3 are positive and significantly related to cash compensation,[16] suggesting that as the size of the IPO client increases the total payment to auditor, lawyer, and printing fees increases (see Simunic [1980] and Mayer et al. [1985]).

Panel C of Table 3 provides average and median residuals from equation (2) that suggest Big Eight firms are being

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[16] Panel B of Table 3 discloses relatively higher correlations between sales, book value of equity, and gross proceeds than any other correlations of other independent variables. Thus, the estimated coefficients in equation (2) should be viewed with caution. This high level of multicollinearity may explain the negative and significant coefficient on stockholders' equity. The purpose of this regression is merely to filter out the size related costs of performing an audit, not to emphasize the magnitudes of the coefficients in equation (2).

Table 3

Two-Stage Regression Estimates:
Equation (2) = Cash Compensation Prediction Model
Equation (5) = Underpricing Model with Dependent Variable = Initial Return and Independent Variables = Age, Type of Offering, Percent Retained by Owners, Oil and Gas Indicator, Underwriter Indicator, and Unexpected Cash Compensation
(n = 2,215)

Panel A. Regression Results:

Dependent Variable—Cash Expenses for Audit, Legal, Printing, and Miscellaneous Fees

$$\text{Cash Comp}_i = a_1 + b_1\,(\text{Gross Proceeds}_i) + c_1\,(\text{Sales}_i) + d_1\,(\text{Equity}_i) + u_i \qquad (2)$$

	Constant	*Gross Proceeds*	*Sales*	*Book Value of Equity*
Equation (2)	178.90638 (4.40544) t=40.61	.003632 (.000233) t=15.61	.00036 (.00006) t=5.88	−.00011 (.00003) t=−3.22

R^2=.183 F-statistic=165.293*

Dependent Variable—Initial Return

$$\text{Initial Return}_i = a_2 + b_2\,(\text{Age of Client}_i) + c_2\,(\text{Type of Underwriting Contract}_i) + d_2\,(\text{Percentage of Ownership Offered}_i) + e_2\,(\text{Oil and Gas Indicator}_i) + f_2\,(\text{Underwriter Reputation Indicator}_i) + r_2\,(u_i) \qquad (5)$$

	Constant	*Age*	*Type of Offering*	*Percent by Owner*	*Oil and Gas*	*Underwriter Indicator*	*Residual from Equation (2)*
Equation (5)	.34275 (.03586) t=9.56	−.00204 (.00096) t=−2.13	−.21628 (.02720) t=−7.95	.10011 (.07378) t=1.36	.13753 (.03712) t=3.71	−.05873 (.03191) t=−1.84	−.00018 (.00006) t=−2.74

R^2=.085 F-statistic=34.116*

Standard errors are in parentheses. The mean of the dependent variable (audit fees, legal fees, and miscellaneous expenses) for equation (2) is $218,929. The means of the independent variables, gross proceeds, sales, and book value of equity, are $9,173,808, $20,825,369, and $7,409,655, respectively. The final variable (residual from eq. (2)) represents the difference between the OLS estimate of auditor, legal, and printing fees and the actual observed fees by IPO client.

* Significant at the .01 level.

paid relatively more than non-Big Eight firms after controlling for client size differences. The residuals for the audit firms that were statistically significant in the indicator variable regressions (Fox, Fox & Co.; Hein & Sikora; McGladrey Hendrickson; and Roth) tend to have the largest negative residuals.

Panel D of Table 3 partitions the CPA firms based on the largest-five, middle-six, and smallest-nine audit firms by client sales revenue from Table 1. These results indicate that the auditor compensation premium is significantly larger for the largest-five firms than for the two remaining groups. In addition, the fee

TABLE 3—*Continued*

Panel B. Pearson Product-Moment Correlation:

	Age	*Type of Offering*	*Percent by Owners*	*Oil and Gas*	*Underwriter*	*Gross Proceeds*	*Sales*	*Book Value of Equity*
Gross Proceeds	.236*	.209*	−.124*	−.063	.375*			
Sales	.328*	.160*	−.122*	−.053	.321*	.538*		
Book Value of Equity	.084*	.035	−.065*	−.072*	.089*	.336*	.525*	
Residual from Equation (2)	.142*	.368*	−.222*	−.060	.279*	.000	.000	.000

* Significant at the .01 level.

Panel C. Average Residual from Equation (2) Panel A by Audit Firm and Big Eight/Non-Big Eight Classification:

				Big Eight	
		Average Residual	*Median Residual*	*Average Residual*	*Median Residual*
(1) AA	(225)	29.258	2.769	23.867	−2.231
(2) AY	(163)	26.901	11.068		
(3) CL	(146)	9.081	−34.347		
(4) DHS	(122)	24.377	22.288		
(5) EW	(141)	28.824	−17.952		
(6) PMM	(191)	34.964	−6.217		
(7) PW	(141)	21.309	7.297		
(8) TR	(153)	10.349	−14.796		

				Non-Big Eight	
				Average Residual	*Median Residual*
(9) AG	(55)	−18.877	−31.567	−32.795	−86.003
(10) FOX	(37)	−69.082	−106.279		
(11) HS	(13)	−105.641	−114.743		
(12) LB	(10)	−124.984	−129.163		
(13) LH	(59)	3.298	−30.437		
(14) MH	(78)	20.577	−24.392		
(15) MHD	(18)	−73.237	−83.854		
(16) MJL	(16)	36.502	−76.752		
(17) NEW	(12)	−116.726	−127.294		
(18) OAD	(10)	30.847	−40.083		
(19) SS	(27)	23.831	−20.503		
(20) R	(21)	−112.410	−130.719		
(21) Oths	(718)	−27.343	−84.363		

Mann-Whitney U-Test	*Probability (two-tailed)*
−12.744	.0000
Chi-Square Median Test	*Probability (two-tailed)*
140.636	.0000

The number of CPA firm clients during the 1975–1984 period is listed in column 2. Columns 3 and 4 present the average and median residual from the regression model of Table 3 for each of 20 CPA firms and the other category. These residuals are the result of relating cash compensation (audit fees, legal fees, and miscellaneous fees) to gross proceeds, sales revenue, and book value of equity. Columns 4 and 5 summarize the average and median residuals by the Big Eight/non-Big Eight classification.

TABLE 3—*Continued*

Panel D. Average Residual from Equation (2) Panel A by Audit Firm and Largest-Five, Middle-Six, and Smallest-Nine Audit Firm Clients by Median Sales Revenue Classification:

		Average Residual	*Median Residual*	*Largest-Five* *Average Residual*	*Largest-Five* *Median Residual*
(1) EW	(141)	28.824	−17.952	26.529	6.216
(2) DHS	(122)	24.377	22.288		
(3) PW	(141)	21.309	7.297		
(4) AY	(163)	26.901	11.068		
(5) AA	(225)	29.258	2.769		
				Middle-Six *Average Residual*	*Middle-Six* *Median Residual*
(6) PMM	(191)	34.964	−6.217	14.877	−15.375
(7) TR	(153)	10.349	−14.796		
(8) CL	(146)	9.081	−34.347		
(9) LH	(59)	3.298	−30.437		
(10) SS	(27)	23.831	−20.503		
(11) AG	(55)	−18.877	−31.567		
				Smallest-Nine *Average Residual*	*Smallest-Nine* *Median Residual*
(12) MH	(78)	20.577	−24.392	−38.381	−92.363
(13) MJL	(16)	36.502	−76.752		
(14) MHD	(18)	−73.237	−83.854		
(15) OAD	(10)	30.847	−40.083		
(16) Oths	(718)	−27.343	−84.363		
(17) FOX	(37)	−69.082	−106.279		
(18) HS	(13)	−105.641	−114.743		
(19) NEW	(12)	−116.726	−127.294		
(20) LB	(10)	−124.984	−129.163		
(21) R	(21)	−112.410	−130.719		

	Mann-Whitney U-Test	*Probability (two-tailed)*
Largest-Five, Middle-Six	−2.379	.0174
Middle-Six, Smallest-Nine	−10.383	.0000

	Chi-Square Median Test	*Probability (two-tailed)*
Largest-Five, Middle-Six	8.789	.0030
Middle-Six, Smallest-Nine	105.453	.0000

Column 1 lists the 20 CPA firms by Largest-Five, Middle-Six, and Smallest-Nine firms by client sales revenue classification from Table 1. The firms are listed by median client sales revenue. The number of firm clients during the 1975–1984 period is listed in column 2. Columns 3 and 4 present the average and median residual from the equation (2) for Table 3 for each of 20 firms and the other category. These residuals are the result of relating cash compensation (audit fees, legal fees, and miscellaneous fees) to gross proceeds, sales revenue, and book value of equity.

premium is significantly larger for the middle-six than for the smallest-nine audit firms. This substantial variation in premiums suggests that, within the historical Big Eight/non-Big Eight classification, audit firms may not be homogeneous [Kinney, 1986]. Again, these results suggest that the traditional Big Eight/non-Big Eight distinction for reputation capital may suffer from substantial measurement error.

In the second stage regression, the residuals from equation (2) and the control variables are regressed on the initial return.[17] Table 3 results are similar to the indicator variable regression results for each of the control variables. The coefficient on the residuals from equation (2) is significantly negatively related to the initial return at the .003 level (one-tailed). For payments to the auditor above that predicted by equation (2), the initial return will be lower, *ceteris paribus*.[18] These results provide direct evidence of a positive relation between the compensation paid to an auditor and the wealth of the incumbent owners of a client. This evidence is consistent with the proposition that an IPO client hires the reputation capital of an auditing firm to "signal" its *ex ante* uncertainty to IPO investors.

Signalling models (e.g., Downes and Heinkel [1982] and Titman and Trueman [1986]) rely on the firm signalling information to the market by undertaking a costly activity that cannot be duplicated by firms not possessing the signalled characteristic. In the market for IPOs, firms appear to signal their *ex ante* uncertainty by hiring a "nationally known" CPA firm to perform the registration audit. This "signal" is credible to the market since auditor compensation is higher *ceteris paribus* for those firms that are commonly viewed as exhibiting firm-specific reputation capital. The two-stage least squares method provides a direct test of the relation between the cost (auditor fees) and the benefit (lower initial return) of this signal.

IV. CONCLUSIONS

It has been argued that the auditor performs the role of attesting to the level of *ex ante* uncertainty faced by the IPO investor. Since owners of the IPO firm choose an auditor from a set of competing CPA firms, value-maximizing owners will choose to employ a particular CPA firm's reputation capital when the marginal benefit equates to the marginal cost.

It was conjectured that a marginal benefit of employing a more reputable audit firm is an increase in the price obtained by the firm that offers the IPO *ceteris paribus*. The descriptive results suggest that the assumption of homogeneity in *ex ante* uncertainty does not hold for particular subsets of IPOs. Larger and less risky clients were audited by Big Eight firms. Although this result is not new [Simunic and Stein, 1987; Beatty, 1989], the cross-sectional tests of the reputation hypothesis necessitate control for differences in client *ex ante* uncertainty there are unrelated to auditor reputation.

Two separate methods of considering auditor reputation were considered. First, a positive relation between four non-Big Eight firm indicator variables and the IPO's initial return was documented. The analysis of linear restrictions implies that there are significant differences in the relation between the initial return and various subsets of audit firms. With the maintained hypothesis that the Big Eight/non-Big Eight dichotomy or largest-five/middle-six/smallest-nine firm trichotomy proxy for differences in firm-specific reputation capital, the results are consistent with the reputation hypothesis. An omitted variables method that measures reputation as the amount of auditor compensation unexplained by measures of the marginal cost of performing the audit was applied. It shows that the residual from the auditor compensation regression is positively correlated with the unobservable auditing firm reputation capital. The results of the two-stage least squares approach provide stronger and more direct evidence of a relation between auditor reputation and the initial return than the traditional indicator variable approach.

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[17] An unreported two-stage least squares model using reported auditor fees from Part II of the registration statement for the 1982–1984 subperiod is consistent with the Table 3 model results. These results are available on request.

[18] The second stage of the two-stage least squares model was analyzed employing a bootstrap technique [Marais, 1984]. Inferences from the probability levels of observing the OLS coefficients with this resampling technique are unchanged.

In both approaches, an omitted variables problem may produce errors in inference. For the indicator variable approach, an omitted variable may explain the relation between the four firms and the initial return. The two-stage regression approach is based upon the notion that the residual from the first regression captures the unobservable reputation variable. An omitted variable in the underpricing regression that is positively related to both the auditor's unexplained compensation and the underpricing of the IPO may explain the observed relation. This omitted variables problem should temper the interpretation of the results of this test of reputation. Despite this limitation, the relation observed in the indicator variable approach and the results provided by the residual approach suggest that hiring of a "nationally known" audit firm is related to less underpricing of an initial public offering of equity securities.

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Identifying Audit Adjustments with Attention-Directing Procedures

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ABSTRACT: Studies of the error-detection performance of audit procedures have found that three attention-directing procedures—client inquiry, expectations based on prior-year errors, and analytical review—signal almost half of the material errors detected. Further, the cost of performing such procedures appears to be relatively low, suggesting a positive cost/effectiveness relation. The primary purpose of the present study is to report detailed results of applying these attention-directing procedures when errors are identified. The sample consists of 186 engagements involving 368 proposed audit adjustments of a Big Eight audit firm. The results corroborate prior studies in that about half of the errors were signaled by the three attention-directing procedures and the *simplest* forms of these procedures (e.g., analytical reviews comparing current- and prior-year balances) identify many errors. Moreover, internal controls appear to condition the diagnosticity of audit procedures. When controls are strong, procedures involving internal accounting data are more diagnostic, while with weak controls evidence external to the accounting records signals relatively more errors.

Auditing standards emphasize that audit procedures should be planned such that the risk of failing to detect material error is held to an acceptable level (e.g., SAS No. 47 [AICPA, 1983]). To achieve this objective, auditors rely on many types of procedures, some of which can be described as "attention-directing"—e.g., analytical review, verbal inquiry of client personnel, and expectations based on errors found in prior years. Attention-directing procedures focus on the identification of amounts, relations, and events that are unusual or unexpected. Potential errors initially signaled by attention-directing procedures are then investigated by using other, often more detailed, audit procedures.

With the exception of analytical review, attention-directing procedures have received little attention in the auditing research literature [Kinney, 1987; Kinney and Felix, 1980]. However, an empirical study by Hylas and Ashton [1982] suggested that attention-directing procedures can be quite useful in identifying material adjustments. In that study, 45.6 percent of a sample of 281 adjustments from 152 audits of Peat Marwick Mitchell & Co. (PMM) were initially signaled by such procedures.

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The study reported here extends Hylas and Ashton [1982] in several ways. Specifically, it (1) provides detailed information on circumstances surrounding the use of the three attention-directing procedures, (2) examines the extent to which the proportion of errors signaled by various procedures is conditional on internal control strength, (3) uses the participating firm's explicit audit planning materiality measure, (4) examines a larger set of detected errors drawn from a different time period, and (5) uses more rigorous and systematic data collection and analysis methods. The paper is organized in four parts. The following section presents the motivation for the present study. This is followed by a description of the study's design. The results are then presented and some conclusions are offered.

MOTIVATION

One motivation for the present study is the possible effect of changes in the professional auditing environment since the Hylas and Ashton [1982] study. The prior sample was from financial statements with December 1978 closings, while the present sample was selected from September 1984 to March 1985 closings. The six intervening years saw increased governmental activities emphasizing audit effectiveness and greater competitive pressures emphasizing audit efficiency [Ashton and Willingham, 1989], as well as movement toward more "structured" audit technologies by many large auditing firms [Cushing and Loebbecke, 1986]. Indeed, the firm in which this and the earlier study were conducted is known to be one of the most highly structured firms in the profession (e.g., Kinney [1986]). Because of these changes, there may be changes in the relations observed by Hylas and Ashton.[1]

A second motivation is to explore some of the *conditions* under which attention-directing procedures may be useful in identifying errors. Possible conditioning factors include materiality, assessments of internal control strength,[2] the auditor's experience, and the motivations of those providing the evidence [Mock and Wright, 1982; Wright and Mock, 1985]. Consider, for example, the finding that financial statement errors often are perpetuated from year to year [Hylas and Ashton, 1982; Kinney, 1979]. Knowing the conditions under which perpetuation occurs should help auditors refine their expectations about errors in the current audit. Expectations based on errors found in prior years is one of three attention-directing procedures investigated here. The other two are analytical review and verbal inquiry of the client. Note that analytical review includes, among other things, comparisons of balances with those of prior years (e.g., SAS No. 56 [AICPA, 1988]), but does not overlap with expectations based on *errors* of prior years. Little is known about the extent to which various analytical review techniques identify errors (e.g., ratio analysis, account balance comparisons, regression analysis). Similarly, little is known about the nature of auditors' verbal inquiries. The usefulness of this procedure may depend on the individuals questioned, their positions within the client firm, the context of the inquiry, or other factors.

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[1] Other studies have also examined error characteristics of accounting populations (e.g., Kinney [1979], Kreutzfeldt and Wallace [1986], Ham et al. [1985], Johnson et al. [1981], Ramage et al. [1979], and Willingham and Wright [1985]), although only Kreutzfeldt and Wallace [1986] have considered the nature, causes, and detection of such errors. Kreutzfeldt and Wallace [1986] investigated error detection by examining more than 1,500 errors from 260 engagements of Arthur Andersen & Co.

[2] A study of clients from the same auditing firm found no relation between errors detected in accounts receivable and inventory and the auditors' assessments of internal control effectiveness [Willingham and Wright, 1985].

An additional motivation is exploration of the implications of an ordering bias. That is, since attention-directing procedures are often applied *early* in an audit, other procedures have a lower likelihood of initially signaling errors. The effect of this bias was investigated by asking the auditors whether they believed the adjustments would have been signaled by a procedure other than the one applied and, if so, to identify the most likely procedure.

Finally, by including proposed audit adjustments regardless of whether they were subsequently "booked" or waived, the present study examines a sample of a broader nature than did Hylas and Ashton [1982], who included data only on individually material adjustments that were booked. Waived adjustments were included based on the presumption that the auditors' first concern is to *detect* errors; then a subsequent decision may be made about whether to waive the adjustment due to considerations such as materiality.[3]

METHOD

The Hylas and Ashton [1982] results were used as a starting point, particularly the categories of initial events and error causes. "Initial events" refers to the audit procedure, circumstances, or event that initially led the auditor to suspect that an error had occurred, and includes the three attention-directing procedures. "Error causes" refers to the auditor's judgment as to the likely cause of the error. Nine categories of initial events and seven categories of error causes were used (see Tables 4 and 5). A questionnaire specified the categories and asked the auditors to simply "check off" their responses—instead of providing narrative descriptions as in Hylas and Ashton [1982]. The questionnaire and related instructions were sent in February 1985 to the auditors working on a random sample of 630 U.S. audits of PMM. The auditors were asked to return the (uncompleted) materials to the firm's executive office if the client chosen was no longer a client of the firm or if the client's year-end fell outside the period of November 1984 to February 1985.[4]

The auditors were asked to provide the requested information for only the four largest proposed adjustments and, in any case, only for adjustments that equaled or exceeded 20 percent of planning materiality. Planning materiality, or "gauge," is defined as $1.6(X)^{.67}$, where X is the larger of total assets at the balance sheet date or net revenues for the year. Gauge (G) was developed by PMM to represent an average level of precision for audit planning purposes [Elliott, 1983], and it provides a common benchmark for expressing the relative sizes of audit adjustments for different clients. Responses were limited to the four largest adjustments to maintain a reasonable response time, since detailed information on each adjustment was requested, and because larger errors are of greater concern to auditors than smaller ones. Thus, only errors that have a reasonable likelihood of aggregating to an amount greater than G were studied. The auditors were further asked to exclude adjustments of a "bookkeeping" nature that are performed as a client service each year, such as anticipated adjustments to deferred and accrued income taxes, since such adjustments are not viewed as errors and involve little or no exposure for the auditor.

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[3] Since the present paper focuses on error *detection* instead of the ultimate resolution of the proposed adjustments, we do not distinguish between booked and waived adjustments in the analyses below. Further information on the waived adjustments is provided by Wright [1988].

[4] A total of 220 uncompleted questionnaires was returned for these reasons. However, the materials for 16 clients having September 1984 and March 1985 year-ends were completed and are included in the results reported below.

The materials sent to the auditors consisted of five parts: (1) a cover letter from the executive office to the managing partner of the office conducting the engagement; (2) a more detailed cover letter to the partner in charge of that particular engagement; (3) instructions for the engagement manager responsible for conducting the audit; (4) more detailed instructions for all personnel assigned to that audit; and (5) the questionnaire. The engagement manager was asked to coordinate completion of the questionnaire, consulting with the in-charge auditor and the audit staff to obtain the detailed information requested on specific adjustments. Questionnaires were distributed either during field work or soon thereafter.[5]

RESULTS

Responses were received from 186 engagements, 92 percent of which are in six broad industry categories: manufacturing, merchandising, commercial banking, savings and loan, insurance, and natural resources. The proportion of sample clients in each industry category is comparable to that of Hylas and Ashton [1982]. Eighty-three percent of the clients have December year-ends. The clients are extremely variable in terms of size. For example, Table 1, which provides summary data on the clients, shows that total assets range from $180,000 to $12.8 billion and gauge ranges from $7,000 to $8.4 million.[6]

The number of errors affecting various accounts is shown in Table 2.[7] Note that the number of errors is not the same as the number of proposed adjustments. Since an adjustment affects at least two accounts, the number of errors must be at least twice as large as the number of adjustments. Table 2 reveals a total of 792 errors, while Table 3 (discussed later) indicates that these errors involved 368 proposed adjustments. The number of engagements with one, two, three, and four adjustments was 43, 18, 15, and 61, respectively. Forty-nine engagements had no proposed adjustments that met the .2G criterion.[8]

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[5] Copies of all materials are available from the authors.

[6] Hylas and Ashton [1982] did not report the mean or range of size measures for their sample. Instead, they reported that their sample was almost equally divided among three asset size categories—greater than $50 million (32 percent), between $10 and $50 million (34 percent), and less than $10 million (34 percent). In the present sample, 51 percent of the clients are in the "greater than $50 million" category, while only 29 percent (20 percent) are in the "between $10 and $50 million" ("less than $10 million") category. Thus, clients in the present sample are, on average, larger than those in the Hylas and Ashton [1982] sample. While inflation over the period 1978 to 1984–1985 undoubtedly explains some of this difference, another important factor is likely to be differences in sample selection procedures. The Hylas and Ashton sample was chosen to yield a relatively uniform distribution of client sizes *within each industry* reported in Hylas and Ashton [1982]. In contrast, the present sample was selected randomly from PMM's client list without imposing size and industry constraints. A different sample of clients—selected in 1981–1982 using procedures similar to ours—produced mean asset and revenue values comparable to those reported in Table 1 (see Ashton et al. [1987]).

[7] In examining errors by account, a difficulty is that the financial statement accounts vary by industry; e.g., a manufacturing company's balance sheet differs from a bank's. Rather than forcing auditors working in different industries to use the same group of accounts, based on a pilot study and discussions with PMM personnel, it was decided to provide industry-specific sets of accounts. Accordingly, four sets of accounts were used: "standard" accounts (for manufacturing, merchandising, and natural resources clients); accounts for insurance companies; banks; and savings and loan clients. Partners at PMM's executive office matched various accounts for insurance companies, banks, and savings and loans to the standard set of accounts in Table 2.

[8] Auditors were also asked to indicate the total number of adjustments detected regardless of their size or nature. About 12 percent of the engagements found one or zero adjustments; 16 percent found two to five; 24 percent found six to ten; and 48 percent found more than ten adjustments.

TABLE 1
SUMMARY DATA ON AUDIT ENGAGEMENTS
(1984–1985)

	Total Sample	*Manufacturing*	*Merchandising*	*Banking*	*Savings and Loan*	*Insurance*	*Natural Resources*	*Other*
Number of engagements	186 (100%)	38 (20%)	18 (10%)	36 (19%)	14 (8%)	46 (25%)	19 (10%)	15 (8%)
Year end:								
September	1%	3%	—%	—%	—%	—%	5%	—%
November	3	5	6	—	—	2	—	9
December	83	68	33	100	79	98	94	91
January	6	5	44	—	—	—	—	—
February	—	—	—	—	—	—	—	—
March	7	19	17	—	21	—	6	—
Financial Data ($000's):								
Revenues:								
Mean	166,516	165,937	121,684	100,211	110,182	234,042	333,776	45,012
Range	197–3,575,234	280–2,115,276	1,044–697,715	500–875,028	1,218–1,162,933	200–3,575,234	2,000–2,265,000	197–185,556
Net Income (Loss):								
Mean	7,325	6,751	3,139	8,122	(1,216)	10,105	16,533	867
Range	(15,436)–148,895	(2,111)–89,804	(462)–16,616	(2,477)–77,254	(15,436)–3,900	(14,806)–148,895	(1,988)–9,600	(49)–3,285
Total Assets:								
Mean	468,551	115,090	57,066	1,023,266	1,172,114	445,087	384,729	39,893
Range	180–12,824,761	180–1,694,956	318–362,841	21,346–8,369,095	17,851–12,824,761	346–8,215,254	3,072–2,685,000	273–229,278
Stockholder Equity:								
Mean	70,555	58,744	26,944	70,113	35,104	90,640	169,552	6,548
Range	(9,665)–1,529,720	(9,665)–537,763	(406)–186,139	1,160–634,154	672–389,457	7–1,529,720	890–1,006,000	230–25,890
Gauge:[a]								
Mean	661	347	310	1,249	1,110	630	616	208
Range	7–8,400	7–2,000	16–1,200	12–6,400	100–8,400	7–6,400	9–3,200	7–600

[a] Gauge is defined as $1.6(x)^{.67}$ and x is the larger of total assets at the balance sheet or net revenue for year.

TABLE 2
SUMMARY DATA ON ERRORS
(1984–1985)

		Direction		Average Size			Percentage of Total Errors Detected[b]							
Account	Number	Over-statement	Under-statement	Amount $(000)	As Percent of Assets	As Percent of Gauge[a]	Total Sample	Manufacturing	Merchandising	Banking	Savings and Loan	Insurance	Natural Resources	Other
Cash	16	6	10	2,199	.6	158	2.0%	—%	2.0%	8.3%	—%	.5%	2.8%	2.8%
Marketable securities and other investments	38	21	17	818	1.2	211	4.8	.9	1.0	13.9	7.1	7.5	.9	5.6
Accounts receivable (net)	70	48	22	443	1.9	146	8.8	9.3	6.1	11.1	17.9	3.5	14.0	13.9
Notes receivable	4	2	2	102	1.6	151	.5	.9	—	—	—	—	1.9	—
Inventory	56	24	32	210	.8	81	7.1	14.4	17.3	—	10.7	—	2.8	5.6
Prepaid expenses and other current assets	26	9	17	554	3.8	161	3.3	3.3	4.1	—	14.3	2.5	4.7	2.8
Long-term investments	4	2	2	334	.2	77	.5	.9	—	—	—	.5	.9	—
Property, plant, and equipment (net)	37	14	23	706	.7	128	4.7	4.7	9.2	3.7	—	—	11.2	5.6
Intangible assets	2	1	1	254	.1	32	.3	—	—	—	—	—	.9	2.8
Deferred charges and other non-current assets	35	11	24	3,162	.4	121	4.4	1.4	—	12.0	—	6.5	5.6	—
Accounts payable	46	21	25	1;177	.7	117	5.8	6.0	9.2	8.3	10.7	—	9.3	5.6
Accrued liabilities	57	17	40	726	4.5	211	7.2	5.1	7.1	6.5	—	13.0	3.7	5.6
Income taxes payable	4	1	3	174	1.3	86	.5	1.9	—	—	—	—	—	—
Other current liabilities	23	10	13	1,277	.3	105	2.9	3.7	1.0	9.3	—	—	3.7	—
Notes payable and long-term debt	7	1	6	1,934	.5	179	.9	.9	1.0	—	.36	.5	1.9	—
Deferred taxes	6	2	4	833	.4	125	.8	.5	—	—	—	.5	3.7	—
Other long-term liabilities	29	11	18	606	.4	75	3.7	.5	2.0	—	—	12.0	.9	2.8
Stockholders' equity	50	28	22	528	.5	93	6.3	4.7	1.0	2.8	10.7	12.5	6.5	2.8
Revenue	62	32	30	371	.9	86	7.8	7.9	5.1	6.5	14.3	8.0	6.5	16.7
Cost of goods sold	83	38	45	420	.8	109	10.5	13.0	15.3	2.8	10.7	12.5	6.5	5.6
Selling expenses	27	11	16	154	.4	172	3.4	5.1	3.1	—	—	6.0	.9	—
Gen. and Admin. expenses	91	39	52	293	1.9	103	11.4	14.4	15.3	11.1	—	9.0	7.5	19.4
Other accounts	19	10	9	590	.2	51	2.4	.5	—	3.7	—	5.0	2.8	2.8
Total errors	792	359	433	693	1.4	124	792	215	98	108	28	200	107	36

[a] Only errors exceeding 20 percent of gauge were reported.

[b] Note that the bottom row of this table presents *number* of errors instead of percentages.

TABLE 3

EFFECT OF ADJUSTMENTS ON INCOME: 1984–1985

(RESULTS FROM HYLAS AND ASHTON [1982] IN PARENTHESES)

			Average Size			Average Income Effect	
Effect	*Number*	*Percentage*	*Amount ($000's)*	*Percent of Assets*	*Percent of Gauge*	*Amount ($000's)*	*Percent of Gauge*
Reduce income	158 (144)	42.9% (51.2)	398 (235)	2.2 (1.4)	141	313 (160)	146
Increase income	104 (102)	28.3 (36.3)	418 (192)	.6 (1.2)	86	347 (154)	72
No effect, i.e., reclassifications	106 (35)	28.8 (12.5)	1,889 (158)	1.5 (1.2)	169	—	—

General Description of the Errors

Great variability in the distribution of errors across both accounts and industries is evident in Table 2. Fifty-two percent of the errors occurred in eight of the 23 accounts listed: accounts receivable; inventory; prepaid expenses; property, plant and equipment; deferred charges; accounts payable; revenue; and cost of goods sold. As expected, the pattern of errors by account differed across industries. There were a relatively large number of inventory and cost of goods sold errors in manufacturing and merchandising companies; receivables and marketable securities/investments errors in commercial banks and savings and loans; accrued liabilities and long-term liabilities errors in insurance companies; and property, plant, and equipment errors in natural resources companies. The variability in the present sample is comparable to that in Hylas and Ashton [1982]. It is also similar to Kinney [1979], who found many adjustments to inventory and cost of goods sold, and to Ham et al. [1985], who found a high incidence of errors in inventory and accounts payable. However, unlike Ramage et al. [1979] and Johnson et al. [1981], who found substantially higher error rates for inventory than for accounts receivable, there are slightly fewer inventory errors.

Table 2 indicates that errors affecting asset accounts were split about evenly between overstatement (138) and understatement (150), while those affecting liability accounts tended more toward understatement (109) than overstatement (63). Over- and understatements were roughly equal for revenue accounts, but more understatements (122) than overstatements (98) were reported for expense accounts. Inventory errors tend to be fairly evenly divided between over- and understatements, while accounts receivable errors tend to be overstatements. While data on error direction were not reported by Hylas and Ashton [1982], the present results generally parallel those of other studies [Kreutzfeldt and Wallace, 1986; Ramage et al., 1979; Kinney, 1979; and Ham et al., 1985].

Income Effects

As mentioned earlier, the 792 errors resulted in 368 proposed adjustments. The income effect of these adjustments is shown in Table 3, which indicates that

TABLE 4
AUDITORS' ASSESSMENTS OF ERROR CAUSES: 1984–1985
(RESULTS FROM HYLAS AND ASHTON [1982] IN PARENTHESES)

	Adjustments			
Cause	*Total* (*n*=*334*)[a]	*Small** (*n*=*236*)	*Moderate*** (*n*=*50*)	*Large**** (*n*=*48*)
Personnel problems	6.3% (26.3)[b]	7.2%	6.0%	2.1%
Insufficient accounting knowledge	28.6 (15.0)	26.8	36.0	31.2
Judgment	20.1 (15.3)	22.9	10.0	16.7
Cut-off or accrual	18.6 (38.1)	17.8	20.0	20.8
Mechanical	12.9 (12.5)	12.7	16.0	10.4
Inadequate control, follow-up, or review	12.6 (9.3)	11.4	12.0	18.8
Other	.9 (19.2)	1.2	—	—

[a] In this and other tables that report breakdowns of the 368 adjustments, the totals sometimes do not add to 368 because of the failure of some respondents to answer a few of the detailed questions we asked.

[b] The percentages for the Hylas and Ashton [1982] study sum to more than 100 percent because more than one factor was identified as causes of some errors.

* Greater than or equal to .2×Gauge but less than Gauge

** Greater than or equal to Gauge but less than 2×Gauge

*** Greater than or equal to 2×Gauge

43 percent of the adjustments would reduce income (i.e., the effect of the errors was to overstate income) and that 28 percent would increase income (the errors understated income). The remaining 29 percent, although they met the .2G criterion, would have no effect on income, i.e., they were reclassification adjustments. The present sample of engagements entails substantially more adjustments that have no income effect than does the Hylas and Ashton [1982] sample. Like the prior study, however, the income-overstatement errors in the present study are larger as a percentage of assets, than are the income-understatement and no-effect errors.

Error Causes

Auditors were asked to indicate what, in their judgment, was the cause of the error that led to each proposed adjustment. They could choose from six types of causes identified in the Hylas and Ashton study. The results, shown in Table 4, indicate that three related causes—personnel problems, insufficient accounting knowledge, and judgment errors—accounted for 55 percent of the errors.[9] This compares with 51

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[9] "Personnel problems" include, for example, inexperience, carelessness, and time pressures, while "insuffient accounting knowledge" refers to insufficient awareness of generally accepted accounting principles and specific client policies. "Judgment errors" refer to

TABLE 5

INITIAL EVENTS THAT IDENTIFIED ADJUSTMENTS: 1984–1985
(RESULTS FROM HYLAS AND ASHTON [1982] IN PARENTHESES)

	Adjustments			
Initial Event	*Total* (*n*=*362*)	*Small** (*n*=*250*)	*Moderate*** (*n*=*56*)	*Large**** (*n*=*56*)
Analytical review	15.5% (27.1)[a]	12.8%	21.4%	21.4%
Tests of detail—analysis and review[b]	28.7 (17.4)	32.4	21.4	19.6
Test of detail—checks for mathematical accuracy	9.7 (10.7)	10.4	9.0	7.2
Tests of detail—documentation	9.1 (19.2)	8.8	8.9	10.7
Client inquiry	13.3 (8.2)	12.8	17.9	10.7
Expectations from the prior year	21.5 (10.3)	20.4	21.4	26.8
General audit procedures	2.2 (2.1)	2.4	—	3.6

[a] The percentages for the Hylas and Ashton [1982] study sum to only 95 percent because a category used in that study ("estimates of value") was not used here.

[b] "Tests of detail—analysis and review" should not be confused with "analytical review." The former category refers to "examination of transaction amounts and descriptions, account balance details, 'work-ups' to support account balances, and data appearing on various types of reconciliations," while the latter refers to "comparisons of current unaudited balances with balances of prior years, predictions of current balances based on exogenous data, and analyses of interrrelationships among account balances" [Hylas and Ashton, 1982, p. 753].

* Greater than or equal to .2×Gauge but less than Gauge

** Greater than or equal to Gauge but less than 2×Gauge

*** Greater than or equal to 2×Gauge

percent in Hylas and Ashton [1982, pp. 760–761]. It is also consistent with the results of Kreutzfeldt and Wallace [1986] who found similar factors to be the predominant causes of errors in their sample. The results for two other error causes—inadequate control, follow-up or review procedures, and mechanical errors—are also consistent with Hylas and Ashton, while substantially fewer cutoff or accrual problems were noted in the present sample of engagements.[10]

Initial Events

Nine categories of initial events were listed in the questionnaire, and the auditors were asked to indicate which was relevant to the error underlying each proposed adjustment. The results, shown in Table 5, indicate that the three attention-directing procedures—expectations from the prior year, client inquiry, and analytical review—initially signaled

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items that must be estimated because exact dollar amounts cannot be determined, e.g., uncollectible accounts, obsolete inventory, and contingencies.

[10] In Table 4 and in other tables that report breakdowns of the 368 adjustments, the totals sometimes do not add to 368 because some respondents' failure to answer a few of the detailed questions asked.

a total of 50.3 percent of the adjustments in this study, which is comparable to the 45.6 percent found by Hylas and Ashton. It is also consistent with the results of Kreutzfeldt and Wallace [1986] who found that attention-directing procedures signaled a large proportion of errors.

Both Hylas and Ashton [1982] and the present study find that expectations signal more larger than smaller adjustments, and that client inquiry is not related to the size of the adjustment. In contrast, the present results suggest that analytical review signals more larger than smaller adjustments, whereas Hylas and Ashton found that analytical review was not related to adjustment size. Tests of detail signaled 47.5 (47.3) percent of all adjustments in the present (prior) study. In addition, tests of detail signaled more smaller than larger adjustments in the samples of both studies. Finally, few adjustments were initially signaled by confirmations or inventory observation in either study.

Another comparison between the present study and Hylas and Ashton [1982] is the detection frequency of initial events for clients in different size categories. Hylas and Ashton found that the percentage of errors signaled by the various initial events differed little across three asset size categories—greater than \$50 million ("large"), between \$10 and \$50 million ("moderate"), and less than \$10 million ("small"). Our results agree, with the exceptions that (1) the three attention-directing procedures identify slightly *more* adjustments in large than in moderate/small clients (55 vs. 45 percent), and (2) tests of detail identify slightly *fewer* adjustments in large than in moderate/small clients (39 vs. 49 percent).

Materiality (Gauge)

Information about materiality is provided in Tables 1–5. Recall that proposed adjustments smaller than 20 percent of gauge (.2G) are not included in our analyses. The mean adjustment size in our sample (1.24G) is much larger than this cutoff, and the range of adjustment size as a percentage of G is substantial (see Tables 1 and 2). Adjustments affecting asset and liability accounts are, on average, about equal in size, while adjustments affecting expense accounts are substantially larger than those affecting revenue accounts. The fact that expense-account errors tend to be understatements while revenue-account errors are about evenly split between under- and overstatements largely explains the finding that income-increasing errors tend to predominate in the sample (see Tables 2 and 3). Gauge was largely unrelated to the auditors' judgments of error causes (see Table 4), but it *was* related to the proportion of adjustments identified by various audit procedures. On the later point, Table 5 reveals that expectations and analytical review identified a greater proportion of large than small adjustments, while tests of detail identified a greater proportion of small than large adjustments.

Internal Control Strength

One client-specific factor that may affect the usefulness of audit procedures is internal control strength. The reliability of accounting records and financial statement data should be enhanced as internal controls are strengthened. Thus, when controls are strong the auditor should be able to place greater reliance on internal accounting records and analytical review. Conversely, when controls are weak the auditor should place less reliance on such evidence [Cushing and Loebbecke, 1983]. We collected information on the relation between control strength and error detection by asking the auditors to indicate the strength of

TABLE 6
INITIAL EVENTS IN DIFFERENT INTERNAL CONTROL ENVIRONMENTS
(1984–1985)

	Internal Control Strength[a]			
	Strong (*n*=*43*)	*Moderate* (*n*=*153*)	*Weak* (*n*=*44*)	*Not Relied On* (*n*=*509*)
Analytical review	14.0%	27.4%	4.5%	13.2%
Tests of detail—analysis and review	39.4	21.6	11.4	30.2
Tests of detail—checks for mathematical accuracy	9.3	5.9	4.5	5.1
Tests of detail—documentation	11.6	4.6	13.6	10.0
Confirmation	4.7	5.2	4.5	1.4
Inventory observation	4.7	—	—	.8
Client inquiry	9.3	6.5	22.7	17.7
Expectations from the prior year	7.0	22.5	38.8	20.4
General audit procedures	—	3.3	—	1.2

[a] Internal control strength is based on the auditors' assessments of controls in the account area(s) in which errors occurred.

controls over each account to which an adjustment was proposed. The controls were rated as strong, moderate, weak, or "not relied on," based on the auditors' earlier assessments of controls and the results of compliance tests. We did not collect control information when adjustments were *not* proposed. The results are shown in Table 6.

The auditors rated controls as strong for only six percent of the accounts in which the particular errors were found, while controls were not relied on in 68 percent of the cases in which errors were detected. Table 6 shows that when controls were moderate or strong, more errors were signaled by procedures that focused on internal accounting records and data. Analytical review and tests of detail-analysis and review were the predominant means of signaling errors when controls were moderate or strong. In contrast, with weaker controls more errors were signaled by prior-year expectations and client inquiry. Overall, attention-directing procedures signaled more errors as controls deteriorated.

Since we did not ask the auditors *why* they chose not to rely on controls, we cannot rule out the possibility that in some cases controls were judged to be strong and the nonreliance decision was made on cost-benefit grounds.[11] Even in those cases where controls were considered too weak to justify reliance, the finding that many errors are detected by attention-directing procedures in such circumstances may not be surprising since weak controls may lead to more (and larger) errors that are relatively easy to detect. Moreover, in the latter case it is not clear whether attention-directing procedures signal more errors in weak control environments because they are used to a greater extent or simply because more errors exist.

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[11] The percentage of discovered errors for which controls were not relied on is unrelated to the client size categories discussed above. The percentages are 66.7, 66.2, and 73.5 for the large, moderate, and small size categories, respectively.

Detailed Results for Attention-Directing Procedures

More detailed information on the nature of the three attention-directing procedures is presented in Table 7 (Expectations), Table 8 (Inquiry), and Table 9 (Analytical Review). The last four items in each table are the same; they focus on the phase of the audit in which the need for an adjustment was signaled and the position and experience level of the person who identified the underlying error. The remaining items in each table relate specifically to only one of the three procedures.

First, consider information that is common to the three tables. Errors could be identified in one of three broad phases of the audit—planning, performance, or review. Tables 7–9 indicate that approximately two-thirds of the adjustments that were signaled by each procedure were identified in the performance phase. However, in the case of expectations (inquiry), about 20 percent (30 percent) were identified in the planning phase. In addition, about 30 percent of the adjustments signaled by analytical review were identified in the review phase.

Tables 7–9 reveal that audit staff and in-charge personnel identified almost half of the adjustments signaled by expectations and analytical review, but only 17 percent of the adjustments signaled by inquiry. In contrast, managers and partners identified 38 percent of the adjustments signaled by inquiry, but only 27 percent (12 percent) of those signaled by analytical review (expectations). This may reflect the fact that managers and partners, who have greater experience, are the ones who normally make inquiries, especially of upper management.

More specific information about each procedure is also provided in the tables. For example, for expectations (Table 7), the auditors were asked to indicate the specific source of evidence that created their expectations, as well as the audit procedure that signaled the need for an adjustment in the prior year. Prior audit differences and prior working paper schedules were the principal sources of expectations, accounting for 72 and 23 percent of the adjustments, respectively. Moreover, tests of details signaled most of the errors in the prior year, but analytical review and client inquiry originally signaled about one quarter of the prior-year errors.

Detailed information on adjustments signaled by client inquiry (Table 8) indicates that 40 percent of such adjustments were identified by inquiries made during work on a specific audit area, while 50 percent were identified during casual conversations with clients. Most of the client personnel who responded occupied accounting or finance positions and were at upper or middle management levels. In most cases their responses were corroborated by detailed tests, but in about 38 percent of the cases responses were corroborated by one of the three attention-directing procedures.

Finally, almost 80 percent of the adjustments signaled by analytical review resulted from simply comparing the current year's account balance with that of the preceding year (see Table 9). Judgmental estimates of account balances sig-

TABLE 7

INFORMATION ON ADJUSTMENTS SIGNALED BY EXPECTATIONS FROM THE PRIOR YEAR
(1984–1985)
($n=78$)

	Adjustments Signaled by Expectations
Form of evidence:	
Prior year correspondence files	1.4%
Prior year working paper schedules	22.5
Notes for subsequent audit	0
Prior audit differences	71.9
Prior financial statements	2.8
Prior planning document	0
Other	1.4
Procedure originally signaling the error in the prior year:	
Analytical review	11.6%
Analysis and review	40.7
Mathematical checks	1.4
Documentation	11.6
Confirmation	2.9
Inventory observation	7.2
Client inquiry	14.5
Other procedure	8.7
Don't know	1.4
Phase of audit when error was detected:	
Initial planning	20.5%
Evaluation of internal control	0
Preparing audit program	1.3
Performing procedures	66.7
Evaluating results of procedures	5.1
Review of field work—	
By assistant staff	0%
By senior	1.3
By manager	5.1
By partner	0
By second partner	0
Person initially detecting error:	
Assistant/staff	30.8%
Assistant/staff-in-charge	15.4
Senior	42.3
Manager	7.7
Partner	3.8
Industry experience of that person:	
Extensive (more than four prior engagements)	16.7%
Moderate (two to four engagements)	48.7
Little (one engagement)	19.2
No experience	15.4
Average experience in public accounting	3.6 years

naled another 18 percent, while regression and time series analysis signaled no adjustments. It is important to recognize, however, that the firm participating in this study *does not use* regression or formal time-series analysis in analyt-

TABLE 8

DETAILED INFORMATION ON ADJUSTMENTS SIGNALED BY CLIENT INQUIRY
(1984–1985)
($n=48$)

	Adjustments Signaled by Inquiry
Primary Context:	
During work on an account/area	40.0%
Inquiries from a standardized questionnaire	3.3
Questions at conclusion of work on an account	6.7
Casual conversation	50.0
Follow-up of discrepancies resulting from audit procedures	.0
Client personnel responding:	
VP Finance/controller	53.6%
Accounting/clerks/staff accountants	10.7
Internal auditor	7.1
Assistant controller	3.6
Treasurer	17.9
President	.0
Other	7.1
Accounting or finance position—yes	87.5%
no	12.5
Level—Upper management	57.5%
Middle management	32.5
Lower management	5.0
Employee	5.0
Inquiry corroborated by:	
Analytical review	7.7%
Analysis and Review	25.7
Mathematical accuracy	2.6
Documentation	20.5
Confirmation	5.1
Inventory observation	0
Further inquiry	25.6
Expectations from prior year	5.1
General audit procedures	7.7

ical review. Firms that routinely use more sophisticated analytical procedures might have discovered the same errors with these methods. However, the available evidence indicates that the use of sophisticated analytical procedures is rare [Spires and Yardley, forthcoming].

Ordering Bias

To investigate the possible ordering bias noted by Hylas and Ashton [1982], the auditors were asked whether they believed the adjustments would have been signaled by some other procedure. All those responding with yes were asked to identify the alternative procedure that most likely would have signaled the adjustment. The results are shown in Table 10.

Overall, the auditors believed that 48.9 percent of all adjustments would have been signaled by some alternative

TABLE 8—*Continued*

	Adjustments Signaled by Inquiry
Phase of audit when error was detected:	
Initial planning	29.2%
Evaluation of internal controls	0
Preparing audit program	2.1
Performing procedures	56.2
Evaluating results of procedures	2.1
Review of field work—	
By assistant staff	0%
By senior	0
By manager	8.3
By partner	2.1
By second partner	0
Person initially detecting error:	
Assistant/staff	8.5%
Assistant/staff-in-charge	8.5
Senior	44.7
Manager	34.0
Partner	4.3
Industry experience of that person:	
Extensive (more than four prior engagements)	61.7%
Moderate (two to four engagements)	29.8
Little (one engagement)	8.5
No experience	0
Average experience in public accounting	4.5 years

procedure. The percentages were higher for adjustments signaled by the three attention-directing procedures than for any of the other six: 48.2 percent, 66.7 percent, and 80.8 percent for analytical review, inquiry, and expectations, respectively. For these three procedures combined, the auditors believed that 122 of 182 adjustments signaled (67.0 percent) would have been identified by an alternative procedure.

As to the phase of the audit (planning, performance, or review) in which adjustments were signaled, the data show that the proportion of adjustments that would be identified by other than attention-directing procedures is greater in earlier than in later phases of the audit. Of the 32 adjustments identified by attention-directing procedures in the (early) planning phase, the auditors believed that 28 (87.5 percent) would have been identified by some other procedure; for the performance phase, the proportion fell to 67.2 percent (82 of 122), and for the (late) review phase it fell again to 42.9 percent (12 of 28). Thus, it appears that an ordering bias is relevant to the interpretation of the present results and those of Hylas and Ashton [1982].[12]

Analytical review was considered the alternative procedure most likely to identify errors that were signaled by expecta-

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[12] We also examined the errors initially signaled by the three attention-directing procedures, but which the auditors believed would *not* have been identified by an alternative procedure. Of particular interest was the perceived causes of those errors. More than half (55 percent) of such errors were believed to have been caused by insufficient accounting knowledge or misapplication of client judgment.

TABLE 9
DETAILED INFORMATION ON ADJUSTMENTS SIGNALED BY ANALYTICAL REVIEW
(1984–1985)
($n=56$)

	Adjustments Signaled by Analytical Review
Analytical Review Procedure:	
Ratio analysis	1.8%
Time-series analysis	0
Comparisons with prior year	78.6
Comparisons to industry	0
Regression analysis	0
Judgmental estimates of account balance	17.8
Other	1.8
Phase of audit when error was detected:	
Initial planning	3.7%
Evaluation of internal controls	0
Preparing audit program	0
Performing procedures	64.7
Evaluating results of procedures	0
Review of field work—	
By assistant staff	3.7
By senior	13.0
By manager	13.0
By partner	1.9
By second partner	0
Person initially detecting error:	
Assistant/staff	30.3%
Assistant/staff-in-charge	14.3
Senior	28.6
Manager	25.0
Partner	1.8
Industry experience of that person:	
Extensive (more than four prior engagements)	46.4%
Moderate (two to four engagements)	28.6
Little (one engagement)	16.1
No experience	8.9
Average experience in public accounting	3.9 years

tions, inquiry, and two additional procedures. Overall, the auditors believed that analytical review would have identified 39.6 percent of all adjustments that would have been identified by alternative procedures. Moreover, they believed that 19.4 percent of the adjustments signaled by an analytical review technique would have been identified by *some other* analytical review technique. Thus, analytical review was regarded as a promising initial event for this sample of engagements.

SUMMARY AND CONCLUSION

The potential usefulness of attention-directing audit procedures as suggested by Hylas and Ashton [1982] is corroborated by the present study, which involved a larger sample of audit adjust-

TABLE 10
EXTENT TO WHICH ADJUSTMENTS WOULD HAVE BEEN SIGNALED BY ALTERNATIVE INITIAL EVENTS (1984–1985)

		Adjustments Detected By								
	All Adjustments (n=326)	*Analytical Review (n=56)*	*Analysis and Review (n=104)*	*Mathematical Checks (n=22)*	*Documentation (n=33)*	*Confirmation (n=10)*	*Inventory Observation (n=3)*	*Inquiry (n=48)*	*Expectations (n=78)*	*General Audit Procedures (n=8)*
Would the adjustment have been signaled by another procedure?										
Yes	48.9%	48.2%	31.1%	36.4%	27.3%	40.0%	0%	66.7%	80.8%	25.0%
No	43.4	46.4	57.2	54.5	69.7	50.0	100.0	25.0	15.4	62.5
Not sure	7.7	5.4	11.7	9.1	3.0	10.0	0	8.3	3.8	12.5
If yes, identify the alternate procedure that most likely would have signaled the error.										
Analytical review	39.6%	19.4%	49.0%	54.5%	22.2%	20.0%	0%	42.4%	44.4%	0%
Analysis and review	32.9	45.1	25.5	27.3	44.5	20.0	0	27.3	34.9	25.0
Mathematical checks	2.9	3.2	2.1	0	11.1	0	0	6.1	0	25.0
Documentation	11.1	22.6	6.4	9.1	0	20.0	0	9.1	11.1	25.0
Confirmation	4.3	0	8.5	0	11.1	0	0	9.1	1.6	0
Inventory observation	.5	0	0	0	0	20.0	0	0	0	0
Client inquiry	2.4	0	6.4	0	0	0	0	0	3.2	0
Expectations from prior year	2.4	6.5	2.1	9.1	0	0	0	3.0	0	0
General audit procedures	2.9	3.2	0	0	11.1	20.0	0	3.0	3.2	0
Other	1.0	0	0	0	0	0	0	0	1.6	25.0

ments, clients of larger average size, a time period encompassing different technology and competitive conditions, and more rigorous research methods. In addition, the study provides descriptive information about materiality, internal control strength, the timing of procedures, and other factors that may aid audit planning and facilitate the design of further research on attention-directing procedures.

While the present study suggests that two-thirds of the selected adjustments signaled by attention-directing procedures would have been signaled by some alternative procedure, the auditors who responded believed that a substantial number of such adjustments would *not* have been signaled by other procedures. Moreover, they believed that analytical review likely would have signaled many errors if some other procedure had not. Analytical review initially signaled 16 percent of the adjustments in this study. Our results show that more than 30 percent of the adjustments signaled by this procedure were identified during the review of field work, thus confirming the importance of the review phase of the audit. Moreover, the types of analytical review techniques that signaled errors throughout the audit were the simpler techniques—judgmental estimates of account balances and, especially, comparisons with balances of the prior year.

The importance of the link between the prior audit year and the current one can be seen in the analytical review results. This link is also related to another attention-directing procedure—expectations based on prior-year errors. Expectations initially signaled almost 22 percent of all the adjustments, and 72 percent of that number could be traced to prior-year audit differences. Another 23 percent could be traced to prior-year working paper schedules. In other words, financial statement errors often are perpetuated from year to year (cf. Kinney [1979]). It seems apparent that auditors should be (and are) aware of the positive association between the prior and the current year's errors.

The third attention-directing procedure investigated—client inquiry—initially signaled more than 13 percent of the adjustments. Fifty percent of this number were signaled through casual conversations with client personnel in accounting or finance positions. In contrast, client inquiries based on standard audit questionnaires signaled only three percent of the adjustments identified by this procedure. This result confirms something that practicing auditors have known for years—that asking appropriate questions of the client is an important aspect of auditing.

A principal feature that characterizes our results is that the *simplest* types of attention-directing procedures initially signal many errors. Expectations based on prior-year errors, analytical reviews comparing prior- and current-year balances, and client inquiries involving casual conversations identified the need for one-third of the adjustments. On the other hand, because of the ordering bias, one cannot infer that other procedures are ineffective in signaling errors. The fact remains, however, that attention-directing procedures *did* signal a large number of errors. Therefore, if the costs of applying such procedures is relatively low, then the results support a strong emphasis on the use of attention-directing procedures.

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Expert Measurement and Mechanical Combination in Control Reliance Decisions

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ABSTRACT: The ability of Einhorn's [1972] "expert measurement and mechanical combination" to eliminate bias and increase consensus in control reliance decisions was examined. This method uses the human to measure cue values and then combines these component judgments with a mathematical model to form global control reliance decisions. Its aim is to eliminate error induced when the human aggregates information into a global judgment. Two groups of senior auditors evaluated a series of cases by either making global control reliance decisions or making component judgments of the strength of the individual controls and compliance tests. Component judgments of the latter group were combined mechanically into an overall judgment. The mechanically combined component judgments were, on average, more like those provided by a group of firm experts and were more consensual than the global judgments. These results are compared to those of prior studies which examined similar aids.

PERHAPS the most consistent finding in more than 30 years of judgment and decision making research is that humans have difficulty drawing inferences from multiple sources of information [Libby, 1981; Ashton, 1982]. Such judgments are less than perfectly consistent and important cues are often ignored or misweighted. Significant evidence of resulting decision error has been reported in important accounting and nonaccounting contexts. On the other hand, one of human decision makers' strengths appears to lie in the ability to code a wide variety of information. These findings have led to interest in methods which take advantage of human abilities to code information and offset, at least in part, weaknesses in the manner in which they combine or aggregate information.

In situations where all decision inputs or cues are in quantitative form, purely mechanical models such as regression or discriminant analysis can be used to combine cues into overall judgments. Einhorn [1972] described a decision aiding approach which is useful in situations where the lack of quantification of

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some cues precludes the use of purely mechanical models. He demonstrated how considerable increments in decision accuracy can be gained by combining the human expert's comparative advantage in coding cues into quantitative form with the consistency and accurate weighting provided by a mechanical combination rule. His method uses the human to measure cue values and then uses a model to combine these component judgments into a global judgment. Practical interest in using methods that rely on the general principle of problem decomposition in accounting has been indicated by development work on such systems by at least two public accounting firms (see Libby [1981, chap. 5]).

Until recently, the superiority of expert measurement and mechanical combination and other methods that rely on mechanical aggregation of component judgments has been accepted in the research literature [Slovic et al., 1977]. Burns and Pearl [1981] and others have presented results which challenge this assumption and discuss conditions under which its validity might be questioned. Furthermore, all three existing auditing studies (discussed below) report cases in which mechanical aggregation of component judgments actually led to performance decrements. Finally, Abdolmohammadi [1987] and Ashton and Willingham [1989] analyzed the major issues involved in using and evaluating decision aids in auditing and other fields. One of their principal conclusions based on these and other findings is the need for empirical evaluation of these techniques before they are accepted in practice.

The current study examines the effectiveness of expert measurement and mechanical combination in the determination of reliance on internal controls using a technique which more closely resembles Einhorn's [1972]. In the experiment, two groups of senior auditors evaluated a series of cases either by making global control reliance decisions for a transaction cycle or by making component judgments of control strength and test strength for each process within the transaction cycle. The component judgments of the second group were combined with a mechanical model. Interjudge agreement or consensus was then compared. When compared with the global judgments, the mechanically combined component judgments were much more consensual, exhibiting 61 percent less interjudge disagreement (measured by mean absolute deviation). The mechanically combined component judgments were also more like global control reliance judgments made by a panel of firm experts for similar cases. These results suggest that Einhorn's technique and similar mechanical combination systems may provide an efficient and effective method for promoting consistency in a firm's practice and adherence to firm policies.

THEORY AND HYPOTHESIS

Pervasive findings of inconsistency and misweighting of cues in human judgment have led to many suggestions to consider replacing the human judge with a mechanical one (reviewed in Libby [1981] and Ashton [1982]). Einhorn's [1972] principal insight was that evidence of inconsistency and misweighting[1] of cues did not imply the need for elimination of the human, but a human-mechanical system. He drew a major distinction between the overall global judgment and the components that went into the decision. Error can enter the global judgment either through mismeasurement of the components or their improper combination and replacing the human combination rule with a mechanical one should eliminate the latter source.

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[1] In Einhorn's framework, the cue weighting process encompasses both the choice of whether or not to attend to a cue and the relative weight placed on those chosen for attention. Cues not attended to are described as being given a zero weight.

When using expert measurement and mechanical combination, the human judge selects the relevant cues, defines their measurement scales, determines the relevant criterion, and provides the inputs into the model in the form of component ratings of cue values. The mechanical combination rule is formed by regressing the component judgments on the criterion. The appropriate functional form of the model is determined, following the judgment literature, by the joint properties of the context and the human information processor [Dawes, 1979].

In Einhorn's study, three expert pathologists evaluated a group of cases, first, by assessing the relative amount of nine histological characteristics and, second, by making a global disease severity rating. To test his method, he compared the accuracy of the physician's global judgments with the validity of judgments formed by regressing the patient's survival time on the nine component scores (the result of expert measurement and mechanical combination). The difference in accuracy was attributed to the differential validity of human versus mechanical combination. In each case the mechanical combination of the component ratings significantly outpredicted the global judgments. The success of the technique is due to the fact that, unlike the human, the model attends to all relevant cues and properly weights them (see fn. 1) and applies the rule with perfect consistency.

In situations for which there is no objective criterion variable such as survival time, Einhorn suggests constructing the models using an expert's global judgment as the criterion (i.e., a "policy capturing" model).[2] In such situations, accuracy improvements cannot be directly assessed, and consensus (interjudge agreement) and similarity to selected experts' judgments are used as alternative measures of judgment quality. Lyness and Cornelius [1982] present evidence of the effectiveness of expert measurement and mechanical combination using a policy capturing model in a performance evaluation task. In their study, separate groups either made global or component judgments or both.[3] They report that the mechanically combined judgments of the component judgment (only) group were significantly more consistent and consensual than the other two groups.

Several factors work against the effectiveness of expert measurement and mechanical combination. First, subjects may be experienced at making global judgments, but be unfamiliar with the nature of the components they are asked to measure or the manner in which they are elicited. This could result in significant bias and random error in the component judgments. Second, significant halo effects could affect the component judgments (i.e., the evaluation of one component may influence the evaluation of a second component). To the degree that the combination rule assumes independence among the component judgments, the mechanically combined component judgments may be more variable than global judgments. Finally, simple mechanical combination rules may not use reasonableness checks to attenuate extreme responses. As a result, any extreme values in component judgments may be automatically transformed into extreme overall judgments. The natural human tendency to avoid extreme responses will limit this effect in global judgments, which may increase their consistency and consensus. This problem is of even greater importance when a multiplicative combination rule, which would amplify any error, is used.

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[2] Significant support for this modeling approach is presented by Ashton [1975], Libby [1975], and Ashton and Willingham [1989].

[3] Since all subjects in the Einhorn [1972] study made both types of judgments, there is a potential confounding effect of the subjects' component judgments on their global judgments. Lyness and Cornelius's [1982] design eliminates this potential confound.

Skepticism about early claims of the effectiveness of mechanically combining component judgments (e.g., Slovic et al. [1977]) is supported by the three existing auditing studies, Jiambalvo and Waller [1984], Daniel [1988], and Kachelmeier and Messier [1988]. These prior studies indicate that decomposition of global judgments into components can actually lead to performance decrements. In Jiambalvo and Waller [1984], component probability assessments of overall audit risk, control risk, and inherent risk were mechanically combined (based on the SAS No. 39 audit risk model) into judgments of test of details risk for an entire account. These mechanically combined probabilities were poorly behaved, often being in excess of 1.0. Daniel [1988] extended Jiambalvo and Waller to include inherent risk as a factor following SAS No. 47 and examined the ultimate risk inferred from the other four components of the model. Her results lead to similar conclusions.[4] Kachelmeier and Messier [1988] found that sample sizes determined using the formula in an AICPA Audit Guide [AICPA, 1983] to mechanically combine component judgments of tolerable error, degree of desired audit assurance, and error expectation were more variable than global judgments of sample size.

These studies illustrate the factors that may reduce the effectiveness of expert measurement and mechanical combination. In each study, subjects in the component judgment conditions were unfamiliar with one or more of the component judgment tasks and no training was provided. Further, in Jiambalvo and Waller [1984] and Daniel [1988], the component judgment tasks were presented in an unfamiliar and difficult form, i.e., probabilities. As a result, there was little consensus in some of the component judgments which was transmitted by the model to the mechanically determined overall judgments. Finally, when extreme (and in fact impossible) overall judgments were produced by mechanically combining the component judgments (e.g., probabilities greater than one in Jiambalvo and Waller [1984]), no reasonableness tests were available to attenuate those extreme judgments.

The current study attempts to avoid these problems by using a mechanical combination method which more closely follows Einhorn's [1972]. It also attempts to apply the technique at a lower level of aggregation in the audit decision process, the determination of control reliance. Einhorn's approach differs in fundamental ways from other problem decomposition strategies. His approach relies heavily on the manner in which the human judge *normally* considers the decision problem and relies on findings from the judgment literature in determining the scaling and combination of cues. Following his approach, we selected the components and their measurement scales in a manner consistent with the firm's documentation of evidence and trained subjects in the use of the component response scales.

The internal control reliance decision is a critical juncture in audit planning and has been the most studied aspect of audit judgment. One of the major findings of this research is a lack of consensus among the decisions of different auditors facing the same circumstances, particularly in the more complex experiments. Pressures relating to potential litigation and efficiency losses indicated by this lack of consensus have focused a great deal of attention on this finding and the need for methods to eliminate this problem [Elliott, 1983]. The critical nature of this decision, the existence of a conceptual model to guide the construction of the combination rule [Libby et al., 1985], and the extensive prior research examining this decision make it a reasonable setting in which to examine the feasibility of using expert measurement and mechanical combination in auditing. In addition, in the practice of the participating firm, these judgments translate directly into sample sizes for substantive tests. Thus, any judgmental differences have direct effects on resource allocations in the audit.

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[4] Kinney [1988] discusses possible misestimates of audit risk resulting from use of the SAS No. 47 formula.

Our principal hypothesis is:

> Control reliance decisions resulting from expert measurement and mechanical combination will be less variable (more consensual) than global judgments.

As suggested above, this hypothesis is based on Einhorn's [1972] proposition that human combination adds significant inconsistency to global judgments.

METHOD

Currently, all Big Eight firms use global judgments to assess achieved control reliance after compliance testing is completed. The experiment was designed to test the relative effectiveness of a global judgment strategy, against that of expert measurement and mechanical combination in control reliance decisions. The interjudge variability of these decisions was compared and the mean control reliance decisions produced under the two conditions were also compared to responses of a panel of more expert subjects to cases with the same control weaknesses and compliance tests. Existing expert measurement and mechanical combination systems used in accounting have two goals: to increase consensus and to implement firm policy [Elliott, 1983]. To the degree that the opinions of firm experts represent firm policy, a comparison to the mean judgments of the firm experts measures attainment of the second goal.

Construction of the Mechanical Combination Model

In the Libby et al. [1985] formulation of the control reliance decision, control reliance for a transaction cycle is a function of three attributes: (1) susceptibility of the accounting processes to error (assuming no controls), (2) the strength of the controls over the processes (assuming compliance), and (3) the strength of the compliance tests of the controls and their results. Conceptually, these three attributes determine process susceptibility, control risk, and compliance risk, which when multiplied, equal the combined risk that a process, i, generates intolerable error which will not be corrected by a control. We will abbreviate the effect of this product of three risks for process i, CW_i or "control weakness$_i$." Assessment of control reliance for the transaction cycle requires aggregation of the CW_i for all processes in the transaction cycle.[5]

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[5] Note that these are the same three risk components assessed in Jiambalvo and Waller [1984] and Daniel [1988], but they are assessed at a much lower level of aggregation; an individual control process versus a whole account. From a practical perspective, subjects in the

In an expert measurement and mechanical combination system designed on the basis of this problem formulation, the three attributes described above would form the component judgments in the system and each component would be assessed for each process in a transaction cycle. For example, in a transaction cycle with ten processes (prepare disbursement request form, key-enter data from disbursement request form, run program to produce weekly disbursements file, etc.), each of the three components would be assessed for each of the ten processes and their related controls. Based on the three assessments for each of the ten processes, a *CW* value would be assigned to each process, and those values would be aggregated to determine control reliance for the cycle.[6]

Libby et al. [1985] found that the effect of weaknesses in control or test strength over one process was not dependent on the level of control or test strength over a second (i.e., there was no interaction between the two). This suggests that a linear function without interaction terms is a reasonable way to aggregate the CW_i into an overall control reliance decision for a transaction cycle. This choice is consistent with findings in the judgment and decision making literature and yields:

$$\text{Control Reliance} = k - \sum_{i=1}^{n} CW_i \quad (1)$$

where:

k = the control reliance for a system with no control or test weaknesses,[7]
CW_i = the effect of the control and/or test weakness over process i given its level of susceptibility, and
n = number of processes in a processing stream which converts transaction data into changes in the ledger accounts in the cycle.

In this model, control reliance for the cycle is reduced for each process for which the control or compliance test is viewed as being less than very strong. The value of each CW_i will depend on the three component judgments made for process i.

Two further simplifications were made in the component judgments' measurement scales based upon discussions with the executive office staff of the participating firm. Process susceptibility was limited to two levels (High and Low) and was assigned based on whether the process was manual or computerized. Likewise, control strength was limited to two levels (Very Effective and Partially Effective) and test strength and result could take three levels (Very Strong, Moderately Strong, and Weak).[8] Given these simplifications, the ten non-zero control weakness coefficients presented in Table 1 and the constant k must be estimated.[9]

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prior studies were required to aggregate each risk over *all* of the processes related to an account, which, itself could induce error.

[6] In a similar fashion, for firms that assess control reliance with respect to a given assertion (e.g., existence), the aggregation could be over those processes related to that assertion.

[7] In this formulation, k does not vary by transaction cycle or client.

[8] Effectively, the last two variables have an additional level, Ineffective and None, respectively. However, these are not directly considered in the experiment because no internal control reliance is allowed by the participating firm in either circumstance unless the deficiency is met by compensating tests. The assignment of values for test strength matched the firm's current compliance testing guidelines.

[9] There are $2\times2\times3=12$ combinations of the three variables. When control strength is very effective and test strength is very strong (for either the high or the low susceptibility process), $CW=0$, because there is no control or test weakness. CW values for the remaining ten combinations and a constant representing a system with no weaknesses must be estimated.

TABLE 1

CONTROL WEAKNESS COEFFICIENTS

Panel A. Low Susceptibility Process:

Control Strength	*Very Effective*			*Partially Effective*		
Test Strength	*Very Strong*[1]	*Moderately Strong*	*Weak*	*Very Strong*	*Moderately Strong*	*Weak*
	0	.74**	1.00*	1.00**	1.88*	2.54*

Panel B. High Susceptibility Process:

Control Strength	*Very Effective*			*Partially Effective*		
Test Strength	*Very Strong*	*Moderately Strong*	*Weak*	*Very Strong*	*Moderately Strong*	*Weak*
	0	.94**	1.38*	1.38**	2.79*	4.08*

[1] 0 because there is no control or test weakness.

* = estimated directly in the regression analysis of the Libby et al. [1985] data (the b_i and c_j in equation (2)), and ** = determined by a committee based on the other coefficients (see fn. 11).

In addition, if more than one accounting process within a transaction cycle was monitored with the same control (e.g., a reconciliation), the processes were treated as a single process for purposes of assessing control reliance.

Control Weakness Coefficients. Six of the control weakness coefficients (noted by single asterisks in Table 1) and the constant k were estimated by analyzing the 96 combined control reliance decisions provided by the 12 internal control experts who participated in Libby et al. [1985]. In that study, each subject made control reliance decisions on a ten-point scale for one-half of the cases formed by manipulating controls and compliance tests relating to one high susceptibility process and one low susceptibility process (holding the controls and tests over the other processes constant at the very effective and very strong levels, respectively). That study made identical changes in the controls and compliance tests for the high and the low susceptibility processes to result in four levels of control and test strength for each process. These were crossed in a 4 X 4 design:

High Susceptibility Process (Manually prepare purchase input)

1. Very Effective Control—Very Strong Test
2. Very Effective Control—Weak Test
3. Partially Effective Control—Moderately Strong Test
4. Partially Effective Control—Weak Test

Low Susceptibility Process (Run computer program to prepare weekly voucher report)

1. Very Effective Control—Very Strong Test
2. Very Effective Control—Weak Test
3. Partially Effective Control—Moderately Strong Test
4. Partially Effective Control—Weak Test

The Libby et al. [1985] data were analyzed in the following regression model with a constant and six (0, 1) indicator variables, three representing whether each of the last three (less than very strong) control-test combinations existed for each of the two processes.[10]

$$\begin{aligned}\textit{Control Reliance} &= k - b_2L_2 - b_3L_3 - b_4L_4 \\ &\quad \underline{\lvert \textit{Low Suscept. Proc.} \rvert} \\ &\quad - c_2H_2 - c_3H_3 - c_4H_4 \\ &\quad \underline{\lvert \textit{High Suscept. Proc.} \rvert}\end{aligned} \qquad (2)$$

where

L_i=indicator variable indicating the existence of one of the above three control weakness coefficients for the low susceptibility process,

b_i=estimate of the effect of L_i on control reliance,

H_j=indicator variable indicating the existence of one of the above three control weakness coefficients for the high susceptibility process, and

c_j=estimate of the effect of H_i on control reliance.

All of the other processes have no control or test weaknesses. The case with no control or test weaknesses (both processes very effective controls—very strong tests) was represented by zero values for all six indicator variables. The case with all very effective controls and very strong tests except for the existence of a weak test of a very effective control over the low susceptibility process was represented by a one on the first indicator variable (L_2) and zeros on the remainder, etc. The case with all very effective controls and very strong tests except for a weak test of a partially effective control over *both* the high and low susceptibility processes was represented by a one for the third and sixth indicator variables (L_4 and H_4) and zeros for the rest. Each of the b_i and c_j coefficients on the indicator variables can be interpreted as a control weakness coefficient (CW_i) which indicates the amount control reliance decreases resulting from that particular weakness in the control-test combination for a process with that level of susceptibility. The six CW_i estimated from the b_i and c_i are noted by single asterisks in Table 1. These six coefficients included those necessary to properly evaluate the six cases used in the current experiment.

The other four coefficients (noted by double asterisks in Table 1) were determined by the consensus of a committee consisting of two partners and a senior manager from the audit practice department in the executive office of the participating firm. These latter four coefficients rarely entered into subjects' models and the results presented in the subsequent section are insensitive to wide variations in their values.[11] The coefficients used in the combination model are presented in Table 1.

Procedure

Participants in the current experiment were randomly assigned to the two treatments (expert measurement and mechanical combination or global judgment) and assigned to separate classrooms during a firm training program for new seniors. The two-hour session, including training and performance of the experiment, was described as an "internal control evaluation module" aimed at examining control concepts.

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[10] Equation (2) is used to estimate CW_i from judgments of control reliance for a cycle. Alternatively, equation (1) estimates control reliance for a cycle from ratings of the components using the CW_i estimates.

[11] The two coefficients for the Moderately Strong Tests of the Very Effective Controls were assigned to have the same proportional relation to the Weak Tests of the Very Effective Controls as the Moderately Strong Tests did to the Weak Tests of the Partially Effective Controls. The values for the Very Strong Tests of the Partially Effective Controls were assigned to be equal to the Weak Tests of the Very Effective Controls.

Improvements in accuracy or consensus resulting from expert measurement and mechanical combination can result from one or both of two factors: the superiority of the mechanical combination rule and/or any increase in reliance on normatively relevant information resulting from training in use of the aid. To decrease the possible impact of training, subjects in *both* groups read an eight-page advance reading and attended a 45-minute training session before performing the task.[12] The advance reading and training described the three components in the model and how they might be applied in practice. The instructors were executive office managers with the firm. The only difference in the training received by the two groups was that the expert measurement group then also received ten minutes of instruction in the use of the necessary response scales for the component judgments. These final instructions were designed to decrease the effect that lack of familiarity with the component judgments might have on the reliability of subject responses. All subjects were familiar with the global judgment scale (described below) which directly matches that used by members of the firm in practice.

The experiment was described as an exercise in which to apply the concepts discussed in the class. Subjects were given one hour to complete their task after which it was collected by an executive office manager. There was no difference between the two groups in time taken to complete the task. Respondents' names were placed on the booklets and consultation among participants was forbidden.

Task

The experimental task was adapted from a subset of the cases used in Libby et al. [1985]. The materials followed the workpaper format used by the participating firm. The unchanging information contained (1) background information about the company which had been a firm client for ten years, (2) a narrative describing the accounting processes in the purchases and payables cycle, (3) boundary control workpapers describing processes, related controls, and relevant tests over the capture of exchange data, and (4) a control point flowchart outlining the processes and information storage media through which the exchange data flow to the relevant accounts.

Following the unchanging information were the six case versions where the controls and compliance tests relating to two of the ten processes in the transaction cycle varied (holding the controls and tests over the other processes constant at the very effective and very strong levels, respectively). The case specific data was presented in control point worksheets that indicate the controls over each process listed on the flowchart and the related compliance tests over the controls. One control point worksheet was presented for each of the six case versions. The control point worksheets were prepared following the firm's documentation policy.

Subjects in the global judgment condition evaluated each of the six case versions, which were printed on separate

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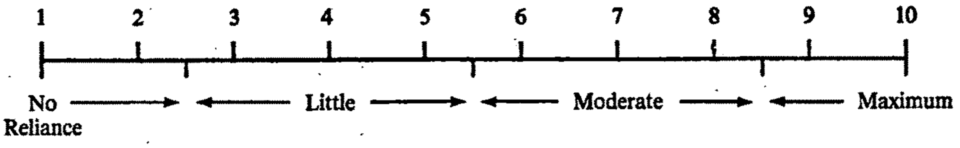
[12] Analysis of the global judgments of a third experimental group who made both component and global judgments would more directly address the effect of directing attention to the relevant cues. However, given Lyness and Cornelius's [1982] finding that the resulting judgments were inferior to either expert measurement and mechanical combination or global judgments, the 50 percent increase in required subject sample size was not considered to be cost effective.

FIGURE 1

RESPONSE SCALE FOR GLOBAL JUDGMENT



control point worksheets. The global judgments were made on the ten-point version of the firm's control reliance scale (used in Libby et al. [1985] and presented in Figure 1), placed at the bottom of each of the six control point worksheets. Those in the expert measurement condition made two evaluations for each of five boundary processes presented in the unchanging background information and the ten processes presented on each of the six control point worksheets. These evaluations (made on spaces directly adjacent to the relevant information on the worksheets) were: (1) whether the strength of the control design was Very Effective or Partially Effective, and (2) whether the compliance test was Very Strong, Moderately Strong, or Weak. This group did not make an overall global judgment for the cases. For both groups, the six case versions varied only with respect to the controls and compliance tests relating to two processes (as described in the next section). Further, these differences were highlighted in boldface type. An example case version used in the expert measurement condition is presented in Appendix I.

Experimental Design and Subjects

Pilot tests indicated that participants could comfortably complete six case versions in the allotted time. In practice, often more than one process in a system is controlled by a less than fully effective control or is tested by a less than very strong compliance test. To include this aspect of the environment in the task, the control strength and test strength of two of the ten different processes within the cycle were varied simultaneously. The controls and tests related to the other eight processes were held constant at the very strong level. Given the limit of six cases, one process, the high susceptibility process, was varied at three levels and the second, low susceptibility process, at two levels. Forming all combinations of the levels of the two processes results in a 3 X 2 design. The 3 X 2 design is outlined in Table 2 and the specific processes, controls, and tests used are listed in Table 3.

Eight-nine auditors attending the firm's new senior school served as subjects. Each participant had completed three busy seasons of audit work. Control reliance decisions are normally the responsibility of auditors at this career stage. All of the auditors completed their assigned tasks.

RESULTS

The control reliance decisions of the subjects in the global judgment condition were compared to derived control reliance decisions formed by combining the component judgments provided by the expert measurement subjects. These latter judgments were formed by subtracting the value of the appropriate coefficient in Table 1 from the constant (determined in the regression equation described above, $k=9.52$) each time an expert measurement subject rated a con-

TABLE 2
DESIGN OF EXPERIMENT: CASE NUMBERS

			High Susceptibility Process		
			Very Effective Control	*Partially Effective Control*	
			Very Strong Test	*Moderately Strong Test*	*Weak Test*
Low Susceptibility Process	Very Effective Control	Very Strong Test	1	2	3
	Partially Effective Control	Weak Test	4	5	6

trol or test as less than very strong for one of the five boundary processes and ten processes on the control point worksheet (see fn. 7).

Since there is no objectively determined normative solution to the cases, the similarity to assessments made by firm experts in similar situations and consensus are used as the measures of accuracy or judgment quality. As a result, the analysis was conducted in three stages. First, the mean control reliance decisions made by each group were compared to each other and to mean responses of the 12 designated firm experts who evaluated situations with the same control and test weaknesses in Libby et al. [1985] (the "expert panel").[13] This provides a preliminary indication of the reasonableness of the expert measurement and mechanical combination model and tests whether the model can make the mean of the less experienced auditors' judgments more like those of the expert panel. Second, for each group, the absolute difference between each individual subject's judgments and the mean judgments of the expert panel were compared to assess accuracy. And third, the consensus of control reliance decisions in the global judgment and expert measurement and mechanical combination conditions were compared.

The Effect on Mean Control Reliance Decisions

Figure 2 presents case means of (1) the global judgment subjects' responses, (2) the expert measurement and mechanical combination subjects' derived judgments, and (3) the expert panel's responses for the same combinations of control and test weaknesses. While all three vectors of means are similar, the expert measurement and mechanical combination subjects' mean derived judg-

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[13] The expert panel included five partners, six senior managers, and one manager from twelve different offices who were selected by their offices as highly experienced in the evaluation of internal control systems for manufacturers.

TABLE 3

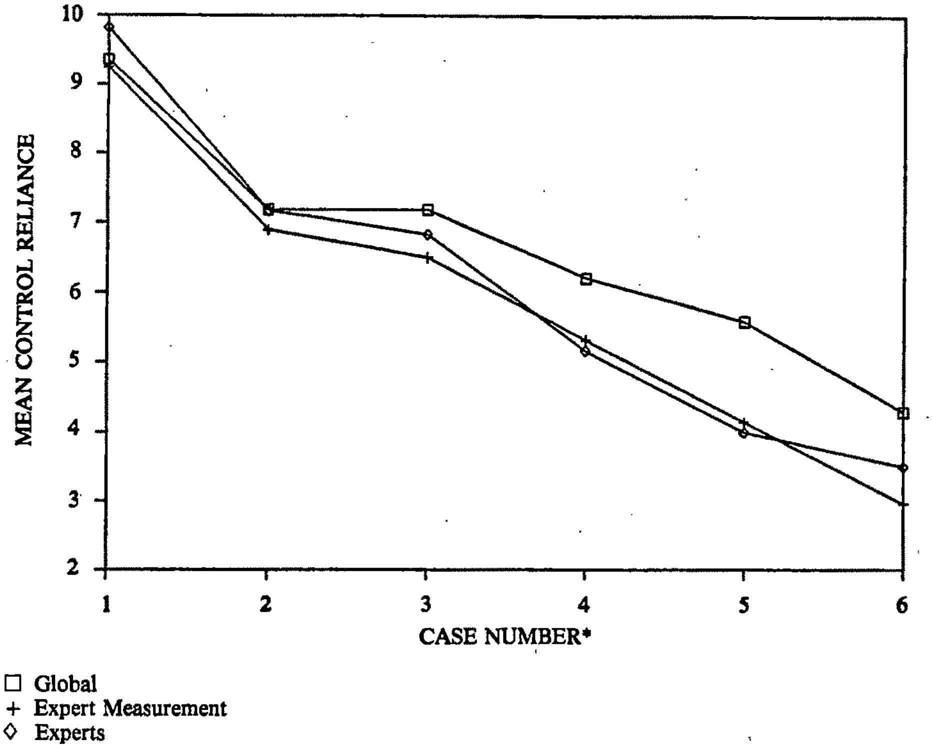
CONTROL AND TEST STRENGTH MANIPULATIONS

High Susceptibility Process (P-6/A-6) Key Enter Data		
Very Effective Control		The total number and dollar amount of all vouchers shown on the printout data that were key-entered are agreed to the respective totals on the purchase input form.
	Very Strong Test	Using a sample of 30 printouts of data that were key-entered, agree total number and dollar amount of all vouchers to the respective week's purchase input form, and note initials of accounting supervisor.
Partially Effective Control		For one randomly selected week per month, the total number and dollar amount of all vouchers shown on the printout of data that were key-entered are agreed to the respective totals on the purchase input form.
	Moderately Strong Test	Through inquiry and observation, ascertain that this control procedure has been properly performed. Scan the file of printouts and purchase input forms for agreement of total number and amount of vouchers.
	Weak Test	Through inquiry and observation, ascertain that this control procedure has been properly performed.
Low Susceptibility Process (P-3/A-3) Run Program		
Very Effective Control		The total number and dollar amount of all checks listed on the monthly disbursement summary are agreed to the sum of the respective totals shown on printouts generated by each weekly run of computer program AP002 (which summarizes each week's disbursements).
	Very Strong Test	Agree total number and dollar amount of checks on the monthly disbursement summary to the sum of the respective totals shown on the weekly summaries, and note initials of treasury clerk, for each month of the year.
Partially Effective Control		For one randomly selected week per month, the total number and dollar amount of all checks listed on the monthly disbursement summary are agreed to the sum of the respective totals shown on printouts generated by each weekly run of computer program AP002 (which summarizes each week's disbursements).
	Weak Test	Through inquiry and observation, ascertain that this control procedure has been properly performed.

ments are more nearly identical to those of the expert panel on whose judgments the model was constructed, but were only .35 closer (on average) on the ten-point scale. The mean responses of the global judgment and expert measurement and mechanical combination subjects were significantly different (Hotelling's T-square, $p=.0000$). The responses of the global judgment sub-

FIGURE 2

COMPARISON OF MEAN JUDGMENTS



* See Table 2 for combination of process susceptibility, control strength, and test strength. For global judgment group $n=45$; for expert measurement group $n=44$.

jects were systematically less conservative than the other two groups for the weaker control-test combination cases.

Accuracy

For each subject, the absolute value of the difference between each of their control reliance ratings and the mean responses of the expert panel was computed. Then the means of these absolute deviations from the criterion were compared between the subjects in the two experimental conditions for each case. The results presented in Table 4 indicate that, in all but case 1 where all controls and tests were very strong, the expert measurement and mechanical combination subjects were significantly more like the expert panel (the absolute deviations were smaller) than the global judgment subjects ($p \leq .0002$). This result supports the ability of the model to make less experienced auditors' judgments more similar to those of expert auditors.

Consensus

Interjudge agreement or consensus in control reliance decisions was examined by comparing the dispersions of the distributions of control reliance decisions between the two experimental treatment groups. The comparisons were made using two methods. First, the variances were compared using the modified Bart-

TABLE 4
TEST OF ABSOLUTE DEVIATIONS FROM THE EXPERT PANEL

*Case Number**	*Condition*	*Mean Deviation from Expert Panel*	*t-statistic*	*p*
1	Global** Component***	.68 .58	.58	.5607
2	Global Component	1.10 .48	3.91	.0002
3	Global Component	1.14 .41	4.44	.0000
4	Global Component	1.62 .53	4.90	.0000
5	Global Component	1.57 .56	5.90	.0000
6	Global Component	1.61 .85	4.27	.0000

* See Table 2 for combination of process susceptibility, control strength, and test strength.
** $n=45$ for all cases.
*** $n=44$ for all cases.

lett's test developed by Box (see Neter et al. [1985]). In all but case 1, the variances of the control reliance decisions derived from the responses of the expert measurement and mechanical combination subjects were significantly smaller than those of the global judgment subjects (see Table 5).

Levine's test of differences in dispersion examines absolute deviations from the mean and, for large samples, is less sensitive to violations of normality (see Brown and Forsythe [1974]). Levine's test was also applied and in cases 2 through 6, the mean absolute deviations of the control reliance decisions derived from the component judgments of the expert measurement subjects were significantly smaller than those of the global judgment subjects ($p \leq .0002$). For case 1, the difference was significant at $p = .056$ (see Table 5).

DISCUSSION

In the results presented above, expert measurement and mechanical combination produced control reliance decisions which were more like those of a firm expert panel and were a greal deal more consensual than global control reliance decisions. Across the six cases, between-judge disagreement, as measured by the mean absolute deviation, was reduced by an average of 61 percent (see Table 5). This suggests that human aggregation of the component judgments added significant inconsistency to the global judgments, supporting Einhorn's [1972] principal claim.

The senior auditors in the global judgment group were less conservative than the expert panel and would, thus, perform less audit work. Combining senior auditors' component judgments with a

TABLE 5

TESTS OF DIFFERENCES IN CONSENSUS BY GLOBAL JUDGMENT AND COMPONENT JUDGMENT WITH MECHANICAL COMBINATION GROUPS

		Bartlett's Test			*Levine's Test*		
*Case Number**	*Group (Condition)*	*Standard Deviation*	F	p	*MAD*	F	p
1	Global** Component***	.92 .76	1.73	.1879	.69 .47	3.75	.0560
2	Global Component	1.35 .83	9.83	.0017	1.10 .40	19.68	.0000
3	Global Component	1.34 .82	9.68	.0019	1.08 .48	15.33	.0002
4	Global Component	1.36 .88	7.83	.0051	1.14 .41	21.70	.0000
5	Global Component	1.52 .87	12.70	.0004	1.24 .45	21.31	.0000
6	Global Component	1.73 .94	14.89	.0001	1.54 .47	41.99	.0000

* See Table 2 for combination of process susceptibility, control strength, and test strength.
** $n=45$ for all cases.
*** $n=44$ for all cases.

model based upon the judgment policy of the expert panel eliminated that bias. This suggests that using the technique to implement firm policy may not only be more effective in producing compliance, but it may also speed adoption of policy changes and reduce training costs. These results strongly suggest the usefulness of the technique both as a consistency inducing device and as a method for implementing firm policy.

The results presented here are in sharp contrast to those of Jiambalvo and Waller [1984], Daniel [1988], and Kachelmeier and Messier [1988] who found performance decrements resulting from decomposing global judgments into components. There are a number of differences between the current study and the prior ones that may contribute to this disparity and suggest the conditions under which decomposition should be more effective. The first set of differences relates to the development of the component variables, their presentation to the subjects, and training in their measurement. In the current study, the selection of the components and their presentation to the subjects matched as closely as possible the existing working paper format used by the participating firm. As a result, many aspects of the required judgment task were familiar to the subjects. Furthermore, subjects were trained in the unfamiliar aspects of the task. In the three prior studies, subjects had no related training or experience with one or more of the component assessments.

The second set of differences relates to construction of the mathematical combination model used to aggregate the component judgments. The prior studies used normative multiplicative combination rules which amplify response errors resulting from any unfamiliarity with the judgment task or any other systematic bias. Of particular concern here is the possibility that the component judgments are nonindependent since the combination rules assume independence (cf. Ravinder et al. [1988]). Although the *CW* coefficients in the current study are the products of three risks, the coefficients were inferred from the judgments of the expert panel and the aggregation model was constructed based on expert assessments, which increases the chances of a reasonable match between the response scales, the coefficient values, and the combination rule. Also, the desirable properties of a linear combination rule (see Dawes [1979]), particularly when variables are measured with error, may be particularly important here.

Although no attempt was made in the current paper to compare expert measurement and mechanical combination to other types of decision aids, the study does bear on construction and evaluation of audit decision aids in general. The type of parametric model constructed here has two principal advantages over a true expert system (cf. Abdolmohammadi [1987]). First, the model can be constructed and empirically evaluated based upon systematic analysis of data. Most attempts at constructing and testing of expert systems in auditing have not relied on such systematic analysis (see Ashton and Willingham [1989]). Second, the cost of constructing simpler decision aids is significantly lower than that experienced by designers of expert systems. Recent research by Stewart et al. [1988] suggests that the increased cost of constructing an expert system does not insure performance superior to that of simpler aids such as the one investigated here (see, also, Carroll [1987]). These factors suggest that expert measurement and mechanical combination systems may be more cost-effective aids in repetitive decision situations.

APPENDIX I
CASE VERSION EXAMPLE

BETTER BEVERAGE CO.
CONTROL POINT WORKSHEET AND PROGRAM
PURCHASING/DISBURSEMENT CYCLE
12/31/X3

Section 1—Identified Processing Controls

Case No. 1

Control Identifier	*Control Description*	*Person/Dept. Performing Control*	*Answers to Question A** (see instructions)	*Performance of Control Documented?*			*Would Control be Effective If Properly Performed?*		*Will Control be Compliance Tested*		*Compliance Tests: Audit Procedures*	*Answers to Question B*** (see instructions)
				Yes	*No*	*How & Where*	*Yes*	*No*	*Yes*	*No*		
R-1	The general ledger balance of accounts payable is reconciled monthly to the subsidiary ledger. All differences are investigated and adjusted.	Acct. supv.	____	X		Reconciliation form	X		X		Agree G/L and subsidiary ledger balance to reconciliation form and verify propriety of adjustments for all months.	____
P-1/A-1	Journal entries recorded in the general ledger are agreed to the totals of the monthly purchase summary and monthly disbursement summary.	Controller	____	X		Initials on journal entries	X		X		Agree entries posted in the general ledger to the totals of the monthly purchase and disbursement summaries, and note controller's initials on journal entries, for each month of the year.	____
P-2/A-2	The total number and dollar amount of all vouchers listed on the monthly purchase summary are agreed to the sum of the respective totals shown on printouts generated by each weekly run of computer program AP003 (which summarizes each week's purchases).	Data control clerk #1	____	X		Initials on monthly purchase summary	X		X		Agree total number and dollar amount of vouchers on the monthly purchase summary to the sum of the respective totals shown on the weekly summaries, and note initials of data control clerk, for each month of the year.	____
P-3/A-3***	The total number and dollar amount of all checks listed on the monthly disbursement summary are agreed to the sum of the respective totals shown on printouts generated by each weekly run of computer program AP002 (which summarizes each week's disbursements).	Treasury clerk		X		Initials on monthly disbursement summary	X		X		Agree total number and dollar amount of checks on the monthly disbursement summary to the sum of the respective totals shown on the weekly summaries, and note initials of treasury clerk, for each month of the year.	
P-4/A-4	The total number and dollar amount of all vouchers listed on the printout generated by computer program AP003 are agreed to the respective totals shown on printouts generated from key-entry of data to the voucher file.	Data control clerk #2	____	X		Initials on printout from AP003	X		X		Using a sample of 30 printouts generated by weekly program AP003, agree total number and dollar amount of vouchers to the totals shown on the respective week's printout of data that were key-entered, and note initials of data control clerk.	____
P-5/A-5	The total number and dollar amount of all disbursements listed on the printout generated by computer program AP004 are agreed to the respective totals shown on printouts generated from key-entry of data to the disbursement file.	Data control clerk #3	____	X		Initials on printout from AP004	X		X		Using a sample of 30 printouts generated by weekly program AP004, agree total number and dollar amount of disbursements to the totals shown on the respective week's printout of data that were key-entered, and not initials of data control clerk.	____

APPENDIX I—*Continued*

Control Identifier	*Control Description*	*Person/Dept. Performing Control*	*Answers to Question A* (see instructions)*	*Peformance of Control Documented?*			*Would Control be Effective if Properly Performed?*		*Will Control be Compliance Tested*		*Compliance Tests: Audit Procedures*	*Answers to Question B** (see instructions)*
				Yes	*No*	*How & Where*	*Yes*	*No*	*Yes*	*No*		
P-6/A-6***	The total number and dollar amount of all vouchers shown on the printout of data that were key-entered are agreed to the respective totals on the purchase input form.	Acctg. supv.		X		Initials on printout	X		X		Using a sample of 30 printouts of data that were key-entered, agree total number and dollar amount of all vouchers to the respective week's purchase input form, and note initials of accounting supervisor.	
P-7/A-7	The total number and dollar amount of all disbursements shown on the printout of data that were key-entered are agreed to the respective totals on the disbursement request form by the accounting supervisor. The total number and amount of all manually-signed checks are agreed to the printout by the treasury secretary immediately prior to mailing the check to vendors.	Acctg. supv./ treas. sec.	———	X		Initials on printout	X		X		Using a sample of 30 printouts of data that were key-entered, agree total number and dollar amount of all disbursements to the respective week's disbursement request form, and note initials of accounting supervisor and treasury secretary.	———
P-8/A-8	The total number and dollar amount of items listed on the purchase input form are agreed to the log of vouchers that was prepared.	Acctg. clerk #3	———	X		Initials on purchase input form	X		X		Using a sample of 30 purchase input forms, agree total number and dollar amount of vouchers to the voucher log, and note initials of accounting clerk.	———
P-9/A-9	The total number and dollar amount of items listed on the disbursement request form are agreed to an adding machine tape count and total of vouchers that were approved for payment by the assistant treasurer.	Acctg. clerk #4	———	X		Initials on adding machine tape	X		X		Using a sample of 30 disbursement request forms, agree total number and dollar amount to adding machine tape. Note initials of accounting clerk on adding machine tape, and note initials of assistant treasurer on all individual vouchers listed on each disbursement request form.	———

Section II—Missing/Ineffective Processing Controls

Identifier	*Missing Control Type*			*Audit Implications of Missing/Ineffective Controls*	*Audit Procedures*
	P	*A*	*R*		
MC-1	X	X		No controls to ensure propriety of journal entry forms prepared by the G/L accountant.	None necessary; P-1/A-1 and R-1 effectively control this activity.

* Space for ratings of control strength.
** Space for ratings of test strength.
*** These lines were boldface in the original.

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Predisclosure Information Search Incentives, Analyst Following, and Earnings Announcement Price Response

Stephen J. Dempsey

ABSTRACT: This paper investigates an *exogenous* proxy for predisclosure information, analyst following, and empirically contrasts its earnings announcement price response performance with the *endogenous* firm size factor. The theoretical motivation for the comparison rests on the premise that the analyst community formulates its preference ranking of firms to follow on the basis of a multivariate information search cost-benefit framework (i.e., incentive considerations in addition to size). The empirical results, based on 2,466 annual earnings announcements over 1976-1982, are consistent with this hypothesis. Regression analyses corroborate the firm size effect found in prior studies as well as a univariate analyst following effect. In a multiple regression model, however, analyst following continues to be incrementally significant while firm size does not. Further analysis demonstrates that thinly followed large firms have significantly larger price reaction than widely followed small firms. Both are supportive of a "non-size-related" analyst following effect.

The "size-related" differential predisclosure information hypothesis presented in Atiase [1980], and the corroborating empirical evidence provided by Atiase [1985 and 1987], Freeman [1987], Collins et al. [1987], and Bamber [1986 and 1987], among others, suggests that the market capitalization of firms is positively related to the timeliness and extent to which preannouncement prices reflect accounting earnings information. Atiase's [1980] hypothesis derives from varying incentive levels by market agents to become informed about firms of differing market value. Specifically, he posits that search incentives increase with size because (1) a larger market capitalization provides opportunities for more net benefits to private information acquisition, and (2) the prices of large firms are less likely to be sensitive to the signalling problems discussed in Grossman and Stiglitz [1976]. That is, it is easier for informed

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traders to conceal their trading activities in the shares of large firms.

This study investigates an *exogenous* proxy for predisclosure information, analyst attention concentration, and empirically contrasts its performance with the *endogenous* firm size factor. The theoretical motivation for this comparison rests on the premise that the analyst community formulates its preference ranking of firms to follow on the basis of a multivariate information search cost-benefit framework. Under this premise, analyst following represents purposeful information production and dissemination activity that inherently reflects incentive in addition to size.[1] The hypothesized advantage is a tighter linkage between the proxy and the net benefits to private information search.

Empirical evidence consistent with analysts' use of a multivariate search incentive framework is provided in Bhushan [1988]. He finds that analysts are more inclined to monitor firms with (1) prospects of higher information-based trading revenues (e.g., larger firms and those with volatile stock prices), and (2) economic fundamentals conducive to low-cost analysis (e.g., firms with low operating diversification and high comovement with the market index). The framework is not captured as felicitously by the firm size variable alone. For example, Bhushan's results indicate that whereas firm size empirically correlates positively with firm complexity (operating diversification) and negatively with share price volatility, the partial correlations between analyst following and these variables fall in opposite directions (concordant with a net benefits preference ordering model).

The empirical results of the present paper are based on 2,466 annual earnings announcements made by New York Stock Exchange (NYSE) firms over the 1976–1982 period. Even though there is high correlation between the two information measures, analyst following is found to provide significant incremental explanatory power beyond firm size in explaining the price response to annual earnings announcements. Firm size, however, is not statistically significant when analyst following is in the model. Further analysis using a 2×2 classification for analyst following and firm size shows that thinly monitored large firms exhibit significantly greater price response than widely followed small firms. Together, the results are consistent with analyst following embodying search incentive information over that associated with firm size alone.

The remainder of the paper is organized as follows. The empirical method is described in Section I and test results appear in Section II. Section III concludes with a summary of the findings.

I. TEST PROCEDURES

Sampling Criteria

The study covers annual (fourth quarter) earnings announcements[2] over the seven-year period, 1976–1982. To be included in the sample, a reporting firm had to satisfy the following data requirements for each of the seven years studied: (1) be included on the Institutional Brokers Estimate System (IBES), (2) have complete daily abnormal return data available on the CRSP daily excess returns tapes, and (3) have market capitalization and announcement date information present on the COMPUSTAT file.

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[1] Although a high correlation between firm size and analyst following is evidence in support of Atiase's [1980] size factor, the mapping between the two is not one to one. Some analysts specialize in smaller firms. Arbel and Strebel [1982] find that, whereas size is a relatively enduring characteristic of organizations, a considerable amount of intertemporal analyst switching takes place. Specifically, firms intensely monitored in some years may receive relatively little coverage in others.

[2] Annual rather than quarterly announcements were used because of the difficulties associated with generating analyst following measures from limited quarterly earnings forecast data. A shortcoming of annual earnings announcements, however, is that the results of the paper are not directly comparable to prior earnings announcement reaction studies using quarterly announcements (e.g., Atiase [1985]).

In addition to these data requirements, the following control filters were implemented separately for each sample year:

1. December 31 closing,
2. Membership on the NYSE,
3. Earnings reported within 75 days of 12/31, and
4. No news announcements other than earnings referenced in *The Wall Street Journal Index* during the report week.

The calendar-year restriction simplifies data collection. The NYSE requirement eliminates from consideration the "exchange effect" documented in Grant [1980] and Atiase [1987], and the 75 day criterion protects against stale earnings information. The "other news" criterion minimizes nonearnings information price effects during the report week.[3] The latter was implemented after the firm size and analyst following measurements were determined (described below) to ensure as much sample information as possible about a firm's relative positioning on these two factors.

Research Design

The announcement period (AP) consists of five trading-days, or approximately one calendar week. Because earnings are typically released on the Broad Tape the day prior to their publication in *The Wall Street Journal*, AP was defined as beginning one trading-day prior to the formal earnings announcement date and ending at the end of the third trading day following the announcement.

A predisclosure period (PP) was used for control purposes to approximate "normal" residual variation as well as to endogenously control for differences in predisclosure period information (see Atiase [1985]). In order to approximate the horizon over which fourth quarter expectations were formed without overlapping third quarter announced results, PP was defined as the 50 trading-day period prior to the announcement period.

The association between analyst following and firm size on announcement period price behavior was assessed using daily returns information obtained directly from the CRSP Daily Excess Returns tapes. The excess returns on these tapes are derived using a portfolio matched-beta approach under Scholes and Williams' [1977] aggregated coefficients method. The procedure attempts to remedy beta biases induced by nonsynchronous trading.

Independent Variables

The analyst following parameter was defined as the average number of analysts (denoted *NOA*) contributing annual earnings forecasts for a particular firm to the November and December[4] listings of IBES. Implicit in this proxy is the assumption that analysts do not differ in quality. Yearly variation (expan-

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[3] Examples of news items occurring during the report week that were deemed potentially confounding include dividend and stock split announcements, new securities offerings, litigation announcements, the awarding of government contracts, news pertaining to mergers, acquisitions and divestitures, and references made in the "Heard on the Street" section of *The Wall Street Journal.*

[4] These two months were chosen to approximate analyst coverage during the fourth quarter. October was excluded because many of the forecasts made during this month pertain to third quarter results not yet disclosed.

TABLE 1

MEDIAN NUMBER OF ANALYSTS (*NOA*[1]) AND MARKET VALUE (*MKTVAL*[2]) BY SAMPLE YEAR

Year	*Median* NOA	*Median* MKTVAL
1976	6.0	$535,277
1977	6.0	509,245
1978	7.0	361,988
1979	7.5	430,794
1980	8.0	480,620
1981	11.0	543,309
1982	10.0	479,116

[1] *NOA* is the November and December average number of analysts contributing forecasts to IBES in a sample year.
[2] Market values in thousands.

sion in the IBES data) was controlled for by scaling each firm's annual *NOA* statistic by the median *NOA* for all sample firms in that year. This yielded the following *relative NOA* measure for firm *i* in year *y*:

$$\text{Rel}\, NOA_{i,y} = \frac{NOA_{i,y}}{\text{Med}(NOA_y)} \qquad (1)$$

where:

$NOA_{i,y}$ = equally-weighted November and December mean number of analysts following firm *i* in year *y*, and

$\text{Med}(NOA_y)$ = median equally-weighted November and December mean number of analysts for all sample firms in year *y*.

The Rel $NOA_{i,y}$ statistics were ranked from high to low. A High-AF designation was given to firms in the top 45 percent of ranked values and a Low-AF designation was given to firms in the bottom 45 percent of ranked values. The decile of observations centered on the median was discarded in order to lend focus to observations in the upper and lower concentration ranks.

The same approach was used for partitions on firm size based on common stock market values (*MKTVAL*) at the end of each sample year. The Rel $MKTVAL_{i,y}$ measures obtained were then used to assign firms to two firm size groups (Small-FS and Large-FS), again deleting the median-centered decile of observations.

Table 1 lists the median values for *NOA* and *MKTVAL* by year. The marked year-to-year variation in these location statistics indicates that the *NOA* and *MKTVAL* distributions are not stationary across time, emphasizing the need for standardizing each firm's value by the annual median.

Tables 2 and 3 summarize the range for *NOA* and *MKTVAL* grouped by decile and AF×FS combination, respectively. To facilitate year-to-year comparability, the *NOA* and *MKTVAL* range statistics reported in the tables have been restated to 1982 (final sample year) equivalents.[5]

Evidence regarding the high covariability between Rel $NOA_{i,y}$ and Rel

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[5] The restatement was accomplished by multiplying each relative measure by the 1982 median. For example, the ranges for *NOA* were formulated from the following measure:

$$\text{Restated } NOA_{i,y} = \text{Rel } NOA_{i,y} \cdot \text{Med}(NOA_{1982}).$$

TABLE 2
RANGE FOR *NOA* AND *MKTVAL* BY DECILE
(ALL YEARS POOLED)[1]
(1976–1982)

Decile	NOA *Range*	MKTVAL *Range*
1	.6– 1.7	$ 9,582–$ 67,076
2	1.8– 3.1	67,076– 124,570
3	3.2– 4.7	124,570– 196,438
4	5.0– 6.5	196,438– 287,470
5	6.6– 8.8	287,470– 584,522
6	9.0–13.8	584,522– 776,168
7	14.0–17.0	776,168– 1,030,099
8	17.1–20.8	1,063,638– 1,566,709
9	20.9–25.8	1,571,500– 2,769,290
10	25.9–45.8	2,769,290– 57,790,972

[1] To facilitate year-to-year comparability, the *NOA* and *MKTVAL* range statistics have been restated to 1982 (final sample year) equivalents.

$MKTVAL_{i,y}$ is provided by the Spearman rank correlation, which was .77 ($p<.01$) overall. Within-year rank correlations over the 1976–1982 horizon were: .78, .79, .80, .76, .76, .79, and .80, respectively.

Dependent Variables

Two alternative indices were used to assess a stock's revaluation during the announcement period. The first response coefficient definition, RC1, follows a squared standardized residual approach, while the second, RC2, is formulated in terms of absolute values:

$$\mathrm{RC1}=\frac{\left(\sum_{t} r_{i,t}^{2}\right)\Big/5}{\left(\sum_{t'} r_{i,t'}^{2}\right)\Big/50} \qquad (2)$$

$$t \in \mathrm{AP};\ t' \in \mathrm{PP},$$

$$\mathrm{RC2}=\frac{\left(\sum_{t} |r_{i,t}|\right)\Big/5}{\left(\sum_{t'} |r_{i,t'}|\right)\Big/50} \qquad (3)$$

$$t \in \mathrm{AP};\ t' \in \mathrm{PP},$$

where:

$r_{i,t}$ = firm i's Scholes-Williams residual on day t during the AP interval and

$r_{i,t'}$ = firm i's Scholes-Williams residual on day t' during the PP interval.

Both indices attempt to capture the average residual variation during the report week relative to the average variation during the predisclosure period.[6] A potential problem associated with RC1 is that it is particularly sensitive to kurtosis in the distribution of predisclosure period residuals, i.e., $r_{i,t'}$ ($t' \in$ PP). For example, if small firms have non-normal distributions of $r_{i,t'}$ with "fat tails" and large firms have (nearly) normal distributions of $r_{i,t'}$, then the denominator of RC1 would tend to be inflated for small firms. A systematically induced bias

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[6] Note that the denominators of both coefficients are defined in consistent fashion with their numerators. An alternative is to first deflate the excess returns in the denominators by the mean residual over the predisclosure period (for RC1 the alternative denominator would be the population variance of residuals taken over PP, i.e., $\sigma^2[r_{i,t'}]$). Since mean excess returns during PP differed negligibly from zero the results obtained using this alternative were essentially identical to those reported.

TABLE 3
RANGE FOR *NOA* AND *MKTVAL*
BY ANALYST FOLLOWING × FIRM SIZE TREATMENT COMBINATION
(ALL YEARS POOLED)
(1976–1982)

AF×FS Combination	NOA *Range*	MKTVAL *Range*
Low-AF × Small-FS[a] (n=1,194)	.6– 9.0	\$ 9,582–\$ 402,457
Low-AF × Large-FS (n=179)	1.0– 9.0	574,939– 5,452,340
High-AF × Small-FS (n=162)	11.3–29.3	52,702– 402,457
High-AF × Large-FS (n=931)	11.3–45.8	574,939– 57,790,972

[a] Low-AF (High-AF) denotes lower 4.5 (upper 4.5) deciles of Analyst Following (AF) measure. Small-FS (Large-FS) denotes lower 4.5 (upper 4.5) deciles of Firm Size (FS) measure.

against Atiase's firm size effect would result through downward pressure on the response coefficient for smaller firms. RC2 mitigates against this potential bias by not squaring the residuals.

II. TEST RESULTS

Pooled cross-sectional regressions were estimated on the natural log of the respective information measures. The comparative equations under the two alternative dependent variable definitions (RC1 and RC2) took the following form (the sample year subscript, y, is suppressed):

$$RC1_i=\beta_0+\beta_1\cdot \ell n(\text{Rel } MKTVAL_i)+e_i \quad (4a)$$

$$RC2_i=\beta_0+\beta_1\cdot \ell n(\text{Rel } MKTVAL_i)+e_i \quad (4b)$$

$$RC1_i=\beta_0+\beta_1\cdot \ell n(\text{Rel } NOA_i)+e_i \quad (5a)$$

$$RC2_i=\beta_0+\beta_1\cdot \ell n(\text{Rel } NOA_i)+e_i \quad (5b)$$

$$RC1_i=\beta_0+\beta_1\cdot \ell n(\text{Rel } MKTVAL_i)+\beta_2\cdot \ell n(\text{Rel } NOA_i)+e_i \quad (6a)$$

$$RC2_i=\beta_0+\beta_1\cdot \ell n(\text{Rel } MKTVAL_i)+\beta_2\cdot \ell n(\text{Rel } NOA_i)+e_i \quad (6b)$$

Regression results are presented in Table 4. Output for equations (4a) through (6a), based on RC1, appear in the upper portion of the table, and output for equations (4b) through (6b), based on RC2, appear in the lower portion. The stronger significance levels for equations (4b) through (6b) suggest that comparatively more statistical resolution is associated with regressions using RC2.[7]

An examination of regression estimates of equation (4a) and equation (4b) indicates that firm size by itself is significant (one-tailed p=.0289 and .0157, respectively), corroborating earlier findings. The results from equations (5a) and (5b) likewise confirm univariate significance for analyst following (p=.0049

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[7] The low R^2s are customary for regressions employing annual earnings announcement data. Larger coefficients are generally obtained for interim announcement data (e.g., Atiase [1985] finds the percentage of explained variation to be in the range of 12 to 15 percent). But there is no *a priori* reason to expect that the detected relations would not also hold for interim announcement data.

TABLE 4

COMPARATIVE REGRESSION RESULTS FOR ANALYST FOLLOWING AND FIRM SIZE AS EXPLANATORS OF DIFFERENTIAL PRICE RESPONSE TO EARNINGS ANNOUNCEMENTS

($n=2{,}466$)

Panel A. Models Employing RC1 *as the Dependent Variable:*

Model								
(4a)	$RC1_t$ =	β_0	+	$\beta_1 \cdot \ell n(\text{Rel } MKTVAL_t)$	+	e_t		
	Coefficients:	1.29		−.04				
	t-statistics:	38.98		−1.90				
	Probability:[a]	.0001		.0289				
	$R^2=.01$							
(5a)	$RC1_t$ =	β_0	+	$\beta_1 \cdot \ell n(\text{Rel } NOA_t)$	+	e_t		
	Coefficients:	1.28		−.08				
	t-statistics:	37.19		−2.59				
	Probability:	.0001		.0049				
	$R^2=.01$							
(6a)	$RC1_t$ =	β_0	+	$\beta_1 \cdot \ell n(\text{Rel } MKTVAL_t)$	+	$\beta_2 \cdot \ell n(\text{Rel } NOA_t)$	+	e_t
	Coefficients:	1.28		.01		−.09		
	t-statistics:	36.98		.10		−1.76		
	Probability:	.0001		.4621		.0395		
	$R^2=.01$							

Panel B. Models Employing RC2 *as the Dependent Variable:*

(4b)	$RC2_t$ =	β_0	+	$\beta_1 \cdot \ell n(\text{Rel } MKTVAL_t)$	+	e_t		
	Coefficients:	1.09		−.02				
	t-statistics:	98.78		−2.15				
	Probability:[a]	.0001		.0157				
	$R^2=.01$							
(5b)	$RC2_t$ =	β_0	+	$\beta_1 \cdot \ell n(\text{Rel } NOA_t)$	+	e_t		
	Coefficients:	1.08		−.04				
	t-statistics:	94.88		−3.31				
	Probability:	.0001		.0005				
	$R^2=.01$							
(6b)	$RC2_t$ =	β_0	+	$\beta_1 \cdot \ell n(\text{Rel } MKTVAL_t)$	+	$\beta_2 \cdot \ell n(\text{Rel } NOA_t)$	+	e_t
	Coefficients:	1.08		.01		−.04		
	t-statistics:	94.32		.54		−2.56		
	Probability:	.0001		.2958		.0053		
	$R^2=.01$							

[a] All probability values are one-tailed.

and .0005, respectively). As to the *incremental* explanatory power of the two information proxies, analyst following in the combined equations (6a) and (6b), continues to be significant ($p=.0395$ and .0053) while firm size does not ($p=.4621$ and .2958). Thus, analyst following appears to carry all the linear explanatory information associated with firm size and more (i.e., the firm size variable is empirically redundant when analyst following is in the equation).[8]

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[8] Multicollinearity diagnostics failed to indicate a correlation induced ill-conditioning of the variance-covariance matrix for equations (6a) and (6b). The variance inflation factor measured 2.4, which is considerably less than the conservative cutoff of 5 suggested in Montgomery and Peck [1982, p. 300]. The inability to find partial significance for the firm size variable in these regressions is therefore not likely to be caused by inflated mean squared errors on the firm size coefficient.

TABLE 5

OFF-DIAGONAL CATEGORICAL ANALYSIS RESULTS FOR LOW-ANALYSTS FOLLOWING × HIGH-FIRM SIZE AND HIGH-ANALYSTS FOLLOWING × LOW-FIRM SIZE

	Low-AF×Large-FS	*High-AF×Small-FS*	*Bootstrap* p-*Value for Mean Difference*[1]
RC1	1.50	1.16	.013
RC2	1.17	1.03	.002
n	179	162	

[1] Simulated probability value for one-tailed test based on 1,000 iterations of bootstrap algorithm.

Note, however, that owing to the high correlation between analyst following and firm size, the above results could obtain due to differential noise levels on the proxy measurements.[9] To provide further evidence on the issue, a nonparametric analysis was undertaken which (1) conservatively controls for Atiase's size effect, (2) is largely insensitive to proxy measurement inaccuracies, and (3) requires no prior assumptions about the functional form of the relation between the information measures and earnings announcement price response.

The investigation centers on the off-diagonal cells of the 2×2 categorical AF and FS independent variable measures. By comparing the mean response coefficients for the Low-AF×Large-FS treatment combination to those for the High-AF×Small-FS treatment combination, firm size differences are negatively offset. A significantly higher mean price response for the Low-AF×Large-FS group than for the High-AF×Small-FS group would therefore be safely interpreted as being due to differences in analyst following and not to Atiase's size effect.

Tests for significant differences between cell means are based on 1,000 iterations of a bootstrapping simulation algorithm. Bootstrapping is a distribution-free test that does not require cross-sectional independence [Foster et al., 1984], yet retains the interval scale of measurement. Therefore, it is locally more powerful than traditional nonparametric tests based on ordinal measurements.

Table 5 presents the mean announcement response coefficients ($\overline{RC1}$ and $\overline{RC2}$) and the underlying number of observations for the off-diagonal AF×FS cells. Of the 2,466 observations, 341 observations (14 percent) fell into one of these two categories, with approximately equal representation in each.

The signs of the differences between the cell means are consistent with a "non-size-related" analyst following effect (for $\overline{RC1}$, $1.50-1.16=.34$, or a 30 percent difference; and for $\overline{RC2}$, $1.17-1.03=.14$, or a 14 percent difference).

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[9] The results may be due to the use of daily returns data since they tend to depart from traditional parametric assumptions. Based on a Kolmogorov-Smirnov goodness-of-fit test on returns taken over PP, the null hypothesis of normality was rejected at the .01 probability level. In regard to cross-sectional independence, an analysis of the PP residual cross-correlation matrix was undertaken for a random selection of 50 firm-year observations (i.e., $50(49)=2{,}450$ pairwise correlations). The tests as suggested in Collins et al. [1982] and described in Morrison [1976, pp. 116–119] is one which compares the correlation matrix to an identity matrix (i.e., complete independence versus at least one significant pairwise correlation). The hypothesis of cross-sectional independence was rejected at $p<.01$.

The bootstrap probability values indicate that for $\overline{RC1}$, the difference is significant at the .013 level, and for $\overline{RC2}$, significant at the .002 level.[10] Consequently, even though the off-diagonal analysis is conservatively biased against finding significance, the results suggest that analysts exploit other search incentive factors that are not necessarily positively related to size.

III. SUMMARY

Analysts would be expected to focus their investigation efforts on the set of securities promising the highest expected after-search-cost realizations to their clients. Analysts would define this set on the basis of firm characteristics yielding the highest expected net payoffs to private information search. From Atiase [1980], firm size as measured by market value is clearly a dominant search incentive consideration; however, other economic attributes also appear to enter into the analysts' incentive framework [Arbel and Strebel, 1982; Bhushan, 1988]. The exogenous analyst following proxy for predisclosure information may therefore be expected to carry explanatory power beyond that associated with the endogenous firm size proxy alone.

The empirical results of the paper are based on 2,466 annual earnings announcements taken over the seven-year horizon, 1976–1982. Regression results support univariate significance for both information measures. In a multiple regression model, however, analyst following remains incrementally significant while firm size does not. Partial significance for the analyst following parameter is consistent with analysts using a multivariate incentive framework that reflects search incentive characteristics in addition to size. The inability to detect partial significance for firm size suggests either that analysts fully exploit size-related incentives, or that firm size is a relatively noisy measurement vis-à-vis the highly correlated analyst following variable. To counteract for the latter possibility, yet control for Atiase's size effect, an off-diagonal analysis was undertaken on dichotomous firm size and analyst following measurements. The results reveal that thinly monitored large firms exhibit significantly more reaction than widely monitored small firms. Consequently, the findings are supportive of a "non-size-related analyst following" effect.

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[10] That is, for RC1, 12 of the 1,000 iterations of the bootstrap algorithm yielded differences larger than the reported difference, and for RC2, only one of the 1,000 iterations yielded a difference larger than the reported difference.

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Selection of Short-Term Accounting-Based Bonus Plans

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ABSTRACT: This paper tests two alternative hypotheses about why different firms choose different accounting measures of performance when determining executive compensation. The two measures of performance examined are accounting profits after income taxes and accounting profits before income taxes. Empirical evidence weakly suggests that the greater the degree to a firm is multinational, the more likely it is to use bonus plans that reward the manager on the basis of after-tax profits, as opposed to before-tax profits. The empirical evidence also suggests that the more capital intensive a firm is, the more likely it is to use bonus plans that reward the manager on the basis of after-tax profits.

THIS paper is a first step in determining why different firms use different accounting measures of performance when determining executive compensation. Specifically, the paper explores why some firms use profits before income taxes (before-tax profits) and other firms use profits after income taxes (after-tax profits) to determine short-term (annual) bonuses for top executives such as the chief executive officer. These short-term bonus plans are commonly used to compensate top executives.[1]

Research in this area is important for several reasons. First, it may increase understanding of how accounting data are used and how firm characteristics affect the accounting data's usefulness for a specific task as little is known about why different firms find different accounting measures of performance useful. Second, by examining why firms select these particular compensation plans, it may be possible to explain why firm specific compensation packages are value maximizing. Third, understanding compensation plan selection may allow determination of how various compensation plans affect managerial decisions (see Raviv [1985]). Finally, accounting

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[1] Fox [1980] finds that in 1980, 90 percent of a sample of manufacturing firms had an annual executive bonus plan providing a year-end bonus based essentially on that year's corporate performance. In 1976 and 1970 the figures are 78 percent [Fox, 1976] and 65 percent [Fox, 1980], respectively.

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studies examining the effect of compensation plans on managerial decision making generally lack explanations for why firms choose their particular plans.[2]

The first of this paper's two hypotheses is that the greater the degree to which a firm is multinational (as opposed to domestic), the more likely it is to use after-tax (as opposed to before-tax) bonus plans. This hypothesis is based on two arguments. First, it will be argued that a manager of a firm with a large proportion of foreign operations has more opportunities available for income tax planning than a manager of a firm with little or no foreign operations. As a result, a firm with a large proportion of foreign operations is more likely to reward a manager on the basis of after-tax profits to motivate the manager to do income tax planning. Second, it will be argued that an after-tax bonus plan might impose less risk on the manager's compensation (via potential tax rate changes) in a firm with a large proportion of foreign operations; and, thus, such firms are more likely to adopt after-tax bonus plans. Empirical evidence weakly suggests that the greater the degree to which firms are multinational (as opposed to domestic), the more likely they are to use after-tax (as opposed to before-tax) bonus plans.

The second hypothesis is that the more capital intensive a firm is, the more likely it is to use after-tax bonus plans. It will be argued that it is more important that managers of capital intensive firms take tax rates into account when making capital investment decisions than managers of noncapital intensive firms. As a result, capital intensive firms are more likely to use after-tax bonus plans in order to motivate managers to take tax rates into account when making investment decisions. Empirical results are consistent with this hypothesis.

The remainder of the paper is organized into four sections. Section I presents hypotheses on the form of the bonus plan used. The method used to test the hypotheses is discussed in Section II; empirical results are presented in Section III. Section IV provides a summary and conclusions.

I. HYPOTHESES ABOUT BONUS PLAN SELECTION

Any incentive contract has both benefits and costs. In the discussion that follows, two firm characteristics are identified under which the additional incentive benefits associated with using an after-tax bonus plan in preference to a before-tax bonus plan are likely to exceed the additional costs associated with the greater compensation risk imposed on the manager via tax rate changes. The two characteristics are the degree to which a firm is multinational and a firm's capital intensity.

Degree to Which a Firm is Multinational

Two reasons are advanced for expecting that the greater the degree to which firms are multinational, the more likely they are to use after-tax bonus plans.

Opportunities for income tax planning: The income tax expense (i.e., the provision for income taxes) will be informative about managerial efforts if managers have income tax planning opportunities. One opportunity for tax planning arises for firms that are multinational. A multinational firm manager (MFM) has a number of ways to reduce taxes. First, the MFM can select a transfer pricing policy for products transferred between affiliates in different countries to lower the tax expense. For example, assume a multinational firm consists of a U.S. parent company and a foreign subsidiary in a country having a lower tax rate than the U.S. tax rate. Also assume that the subsidiary does not distribute its earnings to the U.S. parent and that the indefinite reversal criteria applies to undistributed foreign earnings. The indefinite reversal criteria generally applies to undistributed foreign earnings which are considered permanently invested in the subsidiary (i.e., the earnings are not expected to be distributed nor the stock of the subsidiary sold). Under the indefinite reversal criteria, the parent company does not provide for income taxes on those undistributed earnings.

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[2] For example, Larcker [1983] finds that firms adopting a performance plan increase capital investment relative to nonadopters. However, he states that the results could be due to a selection bias and gives the example that performance plan adopters might have changed corporate investment strategy and simultaneously changed their compensation contracts.

The MFM can reduce tax expense by exporting products or materials from the U.S. parent to the foreign subsidiary at relatively low prices, shifting taxable income from the parent company to the foreign subsidiary. If the subsidiary is in a country having a higher tax rate than the U.S. rate, the manager can reduce taxes by exporting products or materials from the U.S. parent at relatively high prices.

A second opportunity for tax planning that is available to MFMs is choice of locations (countries) for subsidiaries where tax rates are favorable. Furthermore, if a multinational firm already operates in several countries and tax rates vary across these countries, then the manager has the opportunity to increase after-tax profits by taking tax rates into consideration when deciding how to allocate resources (and as a result, pre-tax profits) across world-wide activities. By allocating resources across activities so that the marginal after-tax returns are equal across countries, the firm's after-tax profits will be maximized.

A third opportunity for tax planning occurs if a U.S. parent company regularly receives dividends from a foreign subsidiary. The manager can take advantage of tax treaties and set up holding companies in foreign countries to minimize foreign taxes. By changing the path by which dividends are transferred from a foreign subsidiary to the U.S. parent (e.g., via a third country), the manager may lower foreign taxes.

Establishing an appropriate transfer pricing policy, taking corporate tax rates into consideration when deciding on foreign subsidiary locations and when deciding how to allocate resources across world-wide activities, and taking tax treaties into consideration when receiving dividends from foreign subsidiaries are three ways the MFM can affect the firm's tax expense. In contrast, these opportunities are not available to the domestic firm manager (DFM). This suggests that the incentive benefits associated with motivating the manager to do tax planning are greater for multinational firms than for domestic firms. Therefore, a multinational firm is hypothesized to be more likely than a domestic firm to use an after-tax bonus plan to motivate tax planning.[3] This reason for bonus plan selection is referred to as the "incentive factor."

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[3] Since tax expense, and not the current portion of the provision for income taxes, is deducted in calculating after-tax profits, after-tax bonus plans might not motivate the manager to take actions that delay the timing of tax payments if the actions do not delay the recognition of tax expense. It is not clear why tax expense rather than the current portion of the provision for income taxes is subtracted from pre-tax profits in the bonus plans. However, this is part of the more general question of why accruals and not just cash flows are used in calculating profits for bonus determination. Demski et al. [1984] suggest that accrual accounting procedures provide signals in addition to cash flow data. An alternative explanation might be that there is greater volatility in current taxes than in tax expense. If so, the use of tax expense would impose less risk on the manager's compensation

In the discussion presented thus far, all multinational firms have been assumed to receive the same net benefits from after-tax bonus plans. However, it is reasonable to expect that the incentive benefits would increase as the degree of foreign operations increase. For example, suppose a firm has only one foreign subsidiary. It is located in a high-tax country and it uses intermediate products, produced by the U.S. parent, in the manufacturing of its final products. If the subsidiary's sales and net income are small, an appropriate transfer pricing policy will contribute to a small decrease in the firm's tax expense since the U.S. parent can only export a small amount of intermediate products to the subsidiary. However, if the subsidiary had larger sales, more intermediate products could be used and transfer pricing policies could be more effective in reducing the firm's tax expense. Similarly, the manager's choice of subsidiary location would likely lead to a negligible decrease in the firm's tax expense if foreign operations are small and might lead to a significant decrease in tax expense if foreign operations are large. Thus, the greater the degree to which firms are multinational, the greater are the incentive benefits associated with using an after-tax bonus plan.

Differences in compensation risk: A second possible reason why a MFM's compensation is more likely than a DFM's compensation to be based on before-tax profits is that the multinational firm has its before-tax profits diversified across countries. Therefore, a change in the tax rate of any one country applies to only a portion of its before-tax profits. However, a change in U.S. tax rates applies to a domestic firms' total before-tax profits. As a result, an after-tax bonus plan might impose a greater level of compensation risk, via the tax expense, on the DFM's compensation than on the MFM's compensation. To reduce this greater level of compensation risk, domestic firms are hypothesized to be more likely to reward management on the basis of before-tax profits than are multinational firms. Further, since the level of geographic diversification of before-tax profits is likely to vary with the proportion of foreign operations, it is expected that the greater the degree to which firms are multinational the more likely they are to use after-tax bonus plans. This reason for bonus plan selection is referred to as the "compensation risk factor."

In summary, the discussion suggests that the greater the degree to which firms are multinational, the more likely the additional incentive benefits associated with using after-tax bonus plans in preference to before-tax bonus plans exceed the additional costs associated with the greater compensation risk imposed on the manager.

Capital Intensity

Most production decisions, other than the capital investment decision, change after-tax profits by a scalar multiple (one minus the corporate income tax rate) of the change in before-tax profits. Before-tax bonus plans reward managers on the basis of profits after deducting all costs except for the income tax expense where the income tax expense is reduced by the investment tax credit. As a result, most

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than would the use of current taxes, which might lead to a preference for tax expense. For example, there are more changes in IRS regulations regarding depreciation than in GAAP regulations regarding depreciation. As a result, more volatility will occur in tax depreciation and current taxes than in accounting depreciation and tax expense.

production decisions that maximize before-tax profits would also maximize after-tax profits and most are not dependent upon whether an after-tax or a before-tax bonus plan is used.

For the period of time examined in this study, capital investments were subject to the investment tax credit. As a result, the capital investment decision maximizing before-tax profits would not also maximize after-tax profits (since after-tax profits are a direct function of both before-tax profits and the level of capital investment expenditures). Hence, the capital investment decision is more likely than most other production decisions to depend on whether an after-tax or a before-tax bonus plan is used.[4]

The more important it is that the manager take the investment tax credit into account when making capital investment decisions the more likely a firm uses an after-tax bonus plan. The reason for this is that after-tax bonus plans motivate managers to take the investment tax credit into consideration when making investment decisions whereas before-tax bonus plans do not.[5] It is likely that the more capital intensive a firm is, the greater are the incentive benefits since capital investment decisions are a major part of the firm's operations. However, after-tax bonus plans impose greater risk on the manager's compensation than before-tax bonus plans because of the potential for tax rate changes. This suggests that the more capital intensive a firm is, the more likely the additional incentive benefits associated with an after-tax bonus plan will exceed the additional costs associated with the greater compensation risk imposed on the manager. This leads to the hypothesis that the more capital intensive a firm is, the more likely it is to use after-tax bonus plans.

II. METHOD

The Sample

The sample is 165 firms in the *Fortune* 1000 of 1980 that met two criteria: (1) the firms have an after-tax or a before-tax bonus plan between 1974 and 1976 (see Healy [1985] for a description of these plans), and (2) the firms' 10-K statements for the period 1973 to 1976 were available at the Harvard University business library. The sample contains 56 firms using after-tax bonus plans (after-tax firms) and 109 firms using before-tax bonus plans (before-tax firms).

Due to data limitations described below, the first hypothesis is tested using data on foreign operations from 1977, rather than from 1974–1976. However, it is likely that bonus plans existing in 1974–1976 would continue to exist in 1977. In fact, there appears to be an increase in the use of short-term bonus plans between 1976 and 1980 (see fn. 1).

After-tax and before-tax firms are compared in Table 1 on several dimensions: (1) size as measured by sales, (2) the ratio of long-term debt to firm value, (3) the ratio of firm value to total assets, and (4) systematic risk as measured by beta reported in the 1977 *Value Line In-*

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[4] There have been other types of credits in the 1970s and 1980s. However, with the exception of the foreign tax credit, these other credits are typically much smaller (in terms of the reduction in total tax revenues collected by the government) than the investment tax credit. As a result, after-tax and before-tax bonus plans are likely to motivate managers to take similar labor and raw material input decisions.

[5] Newman [1988] finds that following the 1975 increase in the ITC from seven percent to ten percent, firms using after-tax bonus plans experienced a larger percentage increase in investment spending than did firms using before-tax bonus plans. This suggests that the board of directors may take the ITC into account when choosing between bonus plans, since the choice of bonus plans might influence whether the manager takes the ITC into account when making investment decisions.

TABLE 1

A COMPARISON OF FIRMS USING AFTER-TAX BONUS PLANS WITH FIRMS USING BEFORE-TAX BONUS PLANS ON SELECTED CHARACTERISTICS IN 1977

	After-Tax Firms			*Before-Tax Firms*				
Characteristic	n	*Mean (Standard Deviation)*	*Median*	n	*Mean (Standard Deviation)*	*Median*	*t-statistic for Difference in Means*[1]	*Mann-Whitney* U *Statistic for Difference in Medians*
Sales (in millions)	56	6073 (11254)	1920	109	1245 (1446)	581	3.20*	4.47*
Long-term Debt/ Market Value of Firm[2]	56	0.27 (0.19)	0.26	109	0.25 (0.18)	0.22	0.49	0.51
Market Value of Firm/ Total Assets	56	0.89 (0.52)	0.72	109	0.81 (0.40)	0.70	0.96	0.60
Beta	54	1.07 (0.13)	1.05	103	1.03 (0.21)	1.05	1.34	1.36

[1] The *t*-statistic is adjusted for differences in variances if an *F*-test indicates that the hypothesis of equal variances between the two groups on a specific attribute can be rejected at the .10 level.

[2] The long-term debt is measured by its book value. The firm's market value was calculated by adding the market value of common stock at the firm's fiscal year end to the book value of long-term debt.

* Significant at the .01 level (two-tailed test).

vestment Survey. Two after-tax firms and six before-tax firms are excluded from the systematic risk comparison because of missing data.

Table 1 indicates that on average after-tax firms are significantly larger than before-tax firms at the .01 level. After-tax and before-tax firms do not have significantly different mean betas, or mean ratios of long-term debt to firm value, or firm value to total assets. Median tests using nonparametric Mann-Whitney U statistics are consistent with the mean results.

One possible explanation for the significant difference in size is that size is a proxy for the degree to which firms are multinational. Everything else equal, multinational firms are expected to be larger than domestic firms. Under this interpretation the difference in size would be consistent with the multinational hypothesis. However, size could be proxying for an omitted variable which is a factor in a firm's choice of bonus plans. For example, size could be proxying for economies of scale in tax planning. Or it could proxy for there being more opportunities for tax planning as a firm grows. Size will therefore be included as a covariate in the empirical analysis.

Measures of the Degree to Which a Firm is Multinational

Beginning in 1977, firms with December 31 year-ends are required by SFAS No. 14 to provide information on foreign operations if either of the following conditions were met:

(1) Revenue generated by the enterprise's foreign operations from sales to unaffiliated customers is ten percent or more of consolidated revenue as reported in the enterprise's income statement, or

(2) Identifiable assets of the enterprise's foreign operations are ten percent or more of consolidated total assets as reported in the enterprise's balance sheet.

Firms not having December 31 year-ends were not required to provide information on foreign operations until 1978. Therefore, 1978 foreign operations data are used for the four firms that (1) did not have December 31 year-ends, (2) had foreign subsidiaries in 1977, and (3) did not disclose information on foreign sales and income until 1978. The data obtained from this reporting requirement and others are used to derive the following five measures:

1. $SFTA = SFA/STA$, where SFA represents sales by foreign operations after elimination of intercompany sales and STA represents total company sales after elimination of intercompany sales. There are five firms that only provide information on sales before intercompany eliminations. For these five cases, $SFTA$ is set equal to sales by foreign operations before intercompany eliminations divided by total company sales before intercompany eliminations.[6]
2. $IFT = IF/IT$, where IF represents income from foreign operations and IT represents the firm's total income. Firms provide geographic segment information on income either before eliminations or after

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[6] There are 32 firms having at least one foreign subsidiary that do not disclose SFA (most likely as a result of not meeting either of the two reporting requirements). To distinguish these firms from those that have no foreign subsidiaries ($SFA = 0$), SFA is set equal to five percent of STA, where five percent is the midpoint between zero and the ten percent materiality criteria for reporting information on foreign sales. Information on whether a firm has a foreign subsidiary is obtained from Item 4 of a firm's 10-K statement.

eliminations but not both. The income figures provided are also either before or after taxes. Therefore, this variable is derived by using whichever income numbers are provided.[7]

3. *TXFT=TXF/TXT*, where *TXF* represents foreign tax expense and *TXT* represents the firm's total tax expense. There are 25 cases where *TXF* is not given but the current portion of the provision for foreign and total income taxes are given. For these firms, *TXFT* is set equal to the current portion of the provision for foreign income taxes divided by the total current portion of the provision for income taxes.
4. *TPFT=TPF/TPT*, where *TPF* represents the current portion of the provision for foreign income taxes and *TPT* represents the total current portion of the provision for income taxes. There are 13 cases where *TPF* is not stated but foreign tax expense is. For these firms, *TPFT* is set equal to foreign tax expense divided by total tax expense.[8]
5. *SINT=(STB−STA)/STA*, where *STB* represents total firm sales before intercompany eliminations and *STA* represents total firm sales after intercompany eliminations. There are 18 after-tax firms and 52 before-tax firms for which this measure could not be calculated due to missing data.

The first four variables (*SFTA*, *IFT*, *TXFT*, and *TPFT*) proxy for the manager's opportunity to reduce taxes by taking tax rates into consideration when deciding where to operate foreign subsidiaries. For example, if *SFTA* is large then the foreign subsidiary location choice likely had a large impact on a firm's taxes since foreign operations are large. The fifth variable, *SINT*, is a measure of the manager's opportunity for reducing the firm's tax expense using transfer pricing policies. A necessary condition for transfer pricing policies to reduce the firm's tax expense is that the company make intercompany sales and *SINT* measures the degree to which intercompany sales are made.[9]

The five measures are likely to be correlated with each other. For example, if foreign sales after intercompany eliminations is large, then *SFTA* and *IFT* should be large. One would then expect the foreign tax expense and the current portion of the provision for foreign income taxes to be large, resulting in large values for *TXFT* and *TPFT*. Finally, if there is a large proportion of foreign operations, one might expect transfers to occur between subsidiaries of different countries, giving rise to large values for *SINT*.

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[7] There are 32 cases where firms having at least one foreign subsidiary do not disclose *IF* (29 of these also do not disclose *SFA*). To distinguish these firms from those firms having no foreign subsidiaries, *IF* is set equal to five percent of *IT*. Of the 139 firms in the sample disclosing that they have at least one foreign subsidiary, 107 firms (41 after-tax firms and 66 before-tax firms) disclose geographic segment information on income, either before or after intercompany eliminations. Of the 41 (66) after-tax firms (before-tax firms), 24 (18) report information on income before intercompany eliminations. A chi-square test for independence bonus plan reporting method can be rejected at the .01 level (chi-square statistic (1) = 10.37).

[8] There are 13 cases for which the corporation has foreign subsidiaries but does not disclose either the current portion of the provision for *TPF* or *TXF*. In these cases *TPF* (*TXF*) is set equal to five percent of the current portion of the provision for federal income taxes (the firm's federal tax expense).

[9] Although the five variables are viewed as measures of the opportunity for tax planning, at least *TXFT* and *TPFT* may in turn be influenced by the tax planning itself. To see this, consider the following. If the manager's subsidiary location choice significantly reduces foreign taxes, this might result in small values for *TXFT* and *TPFT*. However, small values for *TXFT* and *TPFT* are supposed to indicate that the subsidiary location choice is not very important. Similar problems could occur with *IFT*, *SFTA*, and *SINT*. To the extent that this problem exists, the power of the tests would be reduced.

Measures of Capital Intensity

Two measures of capital intensity are examined: (1) a three year average investment to sales ratio, and (2) a three year average sales to gross plant ratio. Both were measured over the period 1975–1977. Averages are used to obtain more reliable measures of capital intensity. The measure of investment is the amount spent on plant, property, and equipment and is collected from the COMPUSTAT file and annual reports. The measure typically excludes amounts spent on firm acquisitions. Information on sales and gross plant is also obtained from COMPUSTAT and annual reports.

III. EMPIRICAL TESTS

The first hypothesis is that the greater the degree to which a firm is multinational, the more likely it is to use after-tax bonus plans. Of the 56 after-tax firms in the sample, 50 are multinational firms and of the 109 before-tax firms, 89 are multinational firms.[10] Hence, the proportion of multinational firms using after-tax bonus plans is greater than the proportion of domestic firms using after-tax bonus plans which is consistent with the hypothesis. However, the null hypothesis that the choice of compensation plans is independent of whether the firm is multinational or domestic, cannot be rejected at the .10 level using the chi-square test for independence (chi-square $(1)=1.62$). It should be noted that this test does not distinguish between a multinational firm whose foreign operations are a significant portion of the firm's operations and a multinational firm whose foreign operations constitute only a small fraction of the firm's operations. Therefore, after-tax firms are compared with before-tax firms on the five continuous variables discussed in Section II.

The results of comparisons between after-tax and before-tax firms on the five measures of degree to which firms are multinational are provided in Table 2.[11] On average, after-tax firms are significantly larger than before-tax firms on four of the five variables at the .01 level using a one-tailed *t*-test and on one of the five variables (*SINT*) at the .05 level using a one-tailed *t*-test. The two groups of firms differ at the .01 level on all five variables using the Mann-Whitney *U* test. These results are consistent with the hypothesis that the greater the degree to which firms are multinational, the more likely they are to use after-tax bonus plans.

The correlation coefficients between the five measures of degree to which firms are multinational are presented in Table 3. The pairwise correlations between the five measures are significant at the .01 level. Furthermore, seven of the ten correlation coefficients are above 0.5. This indicates that, to a large extent, the five variables might be measuring a common phenomena.

Earlier it was shown that on average after-tax firms are larger in size than before-tax firms. One possible explana-

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[10] Information in Item 4 in the 1977 10-K statements is used to classify firms as either multinational or domestic. Firms are classified as domestic if no foreign subsidiaries are listed in Item 4.

[11] One after-tax firm is excluded from the analysis of *TXFT* since the firm has a positive value for foreign tax expense, but a negative value for total tax expense. Therefore, it is not meaningful to calculate *TXFT* for this firm. Similarly, two after-tax firms and two before-tax firms are excluded from the analysis of *TPFT* since these four firms have a current portion of the provision for foreign income taxes that is positive, but the total current portion of the provision for income taxes is negative. If *TXFT* and *TPFT* are set equal to one in the above cases, there would be no important changes in the results of Table 2.

TABLE 2

A COMPARISON OF FIRMS USING AFTER-TAX BONUS PLANS WITH FIRMS USING BEFORE-TAX BONUS PLANS ON MEASURES OF THE DEGREE TO WHICH FIRMS ARE MULTINATIONAL IN 1977

	After-Tax Firms			*Before-Tax Firms*				
Characteristic	n	*Mean (Standard Deviation)*	*Median*	n	*Mean (Standard Deviation)*	*Median*	*t-statistic for Difference in Means*[1]	*Mann-Whitney U Statistic for Difference in Medians*
Foreign Sales/Total Sales, after Intercompany Eliminations (*SFTA*)	56	0.23 (0.18)	0.21	109	0.15 (0.15)	0.11	2.81**	2.83**
Foreign Income/Total Income (*IFT*)	56	0.21 (0.18)	0.17	109	0.13 (0.14)	0.08	3.05**	2.84**
Intercompany Sales/ Total Sales after Intercompany Eliminations (*SINT*)	38	0.07 (0.07)	0.05	57	0.04 (0.06)	0.01	2.37*	2.77**
Foreign Tax Expense/ Total Tax Expense (*TXFT*)	55	0.33 (0.32)	0.23	109	0.16 (0.21)	0.10	3.47**	3.82**
Current Portion of the Provision for Foreign Income Taxes/ Total Current Portion of the Provision for Income Taxes (*TPFT*)	54	0.34 (0.33)	0.22	107	0.19 (0.26)	0.10	3.01**	3.35**

[1] The *t*-statistic is adjusted for differences in variances if an *F*-test indicates that the hypothesis of equal variances between the two groups on a specific attribute can be rejected at the .10 level.

* Significant at the .05 level (one-tailed test).

** Significant at the .01 level (one-tailed test).

Table 3

Correlations Between the Five Measures of Degree to which Firms are Multinational, Sales, and Two Measures of Capital Intensity[1]

	SINT	SFTA	IFT	TPFT	TXFT	*Sales*	I/S
SFTA	0.51*** (*n*=95)						
IFT	0.39*** (*n*=95)	0.82*** (*n*=165)					
TPFT	0.37*** (*n*=93)	0.50*** (*n*=161)	0.53*** (*n*=161)				
TXFT	0.40*** (*n*=94)	0.57*** (*n*=164)	0.60*** (*n*=164)	0.87*** (*n*=161)			
Sales	0.33*** (*n*=95)	0.38*** (*n*=165)	0.27*** (*n*=165)	0.26*** (*n*=161)	0.28*** (*n*=164)		
I/S	0.18* (*n*=95)	0.07 (*n*=165)	0.11 (*n*=165)	0.25*** (*n*=161)	0.25*** (*n*=164)	0.10 (*n*=165)	
S/G	−0.26** (*n*=95)	−0.17** (*n*=165)	−0.17** (*n*=165)	−0.26*** (*n*=161)	−0.29*** (*n*=164)	−0.14* (*n*=165)	−0.57*** (*n*=165)

[1] *SINT*= intercompany sales/total sales after intercompany eliminations
SFTA= foreign sales/total sales, after company eliminations
IFT= foreign income/total income
TPFT= current portion of the provision for foreign income taxes/total current portion of the provision for income taxes
TXFT= foreign tax expense/total tax expense
I/S= the average of the 1975, 1976, and 1977 capital investment to sales ratio
S/G= the average of the 1975, 1976, and 1977 sales to gross plant ratio
* Significant at the .10 level (two-tailed test).
** Significant at the .05 level (two-tailed test).
*** Significant at the .01 level (two-tailed test).

tion given for this result was that size itself might be a proxy measure for the degree to which firms are multinational. Table 3 indicates that the correlations between sales and the five measures of degree to which firms are multinational are between .255 and .378 and are significant at the .01 level. This is consistent with size being a proxy measure for the degree to which firms are multinational, or with size proxying for some omitted variable which is a factor in the selection of bonus plans. The combined impact of capital intensity and the degree to which firms are multinational on the choice of bonus plans after controlling for size is analyzed below.

The second hypothesis is that the more capital intensive a firm is, the more likely it is to use after-tax bonus plans. Table 4 provides comparisons of after-tax firms with before-tax firms on the two measures of capital intensity. On average, after-tax firms have significantly larger ratios of investment to sales than before-tax firms at the .01 level using a one-tailed *t*-test and have significantly smaller ratios of sales to gross plant (.01 level) than before-tax firms. The two groups also differ at the .01 level on each variable using the Mann-Whitney *U* test. These results are consistent with the capital intensity hypothesis and indicate that after-tax firms spend a larger frac-

TABLE 4

A COMPARISON OF FIRMS USING AFTER-TAX BONUS PLANS WITH FIRMS USING BEFORE-TAX BONUS PLANS ON MEASURES OF INVESTMENT INTENSITY

	After-Tax Firms			*Before-Tax Firms*				
Characteristic	n	*Mean (Standard Deviation)*	*Median*	n	*Mean (Standard Deviation)*	*Median*	t-*statistic for Difference in Means*[1]	*Mann-Whitney U Statistic for Difference in Medians*
Captial Investment/Sales (I/S)[2]	56	0.08 (0.06)	0.06	109	0.05 (0.03)	0.04	3.45*	3.04*
Sales/Gross Plant (S/G)[2]	56	2.09 (1.16)	1.73	109	2.97 (1.83)	2.52	−3.76*	−3.28*

[1] The t-statistic is adjusted for differences in variances if an F-test indicates that the hypothesis of equal variances between two groups on a specific attribute can be rejected at the .10 level.

[2] The I/S (S/G) results are based on the average of the 1975, 1976, and 1977 capital investment to sales (sales to gross plant) ratios.

* Significant at the .01 level (one-tailed test).

tion of each sales dollar on capital investment and that it takes a larger amount of gross plant to generate a sales dollar.[12] The correlation between the two measures of capital intensity is significantly positive at the .01 level (as reported in Table 3).

Logit regression analyses examine the combined impact of capital intensity and the degree to which firms are multinational on the choice of bonus plans after controlling for size. The dependent variable is a dichotomous measure indicating type of compensation plan and the independent variables include the investment to sales ratio (*I/S*), sales, and one of the five multinational measures. Only one of the five multinational measures is included in any one model because of the high degree of multicollinearity among the measures.

The results of these logit regressions are provided in Table 5. The coefficients of *IFT* and *TXFT* are positive and significant at the .05 level and the .10 level, respectively, using a one-tailed test. The coefficients of the other three measures of degree to which firms are multinational are not significant at the .10 level.[13] The coefficient of the investment to sales ratio is positive and significant at the .01 level using a one-tailed test in each of the five analyses. The R^2 statistics reported range between 15.3 percent and 23.1 percent. When size is excluded from the models, the R^2 statistics range between 7.2 percent and 11.2 percent. These results are weakly consistent with the multinational hypothesis and are consistent with the capital intensity hypothesis.[14,15]

As an additional test, a principal components analysis was conducted on four of the five measures of degree to which firms are multinational to obtain a more reliable measure which might, in turn, increase the power of the logit analysis. *SINT* is excluded from the analysis because of the number of missing observations. The analysis indicates that the first principal component provides a good summary of the data, accounting for 73.7 percent of the standardized variances. Furthermore, the four variables have almost identical correlations with the first principal component. When the measure is included in the logit regression, the coefficient is significant at the

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[12] Two sensitivity analyses were conducted on the measures of capital intensity. The first examined whether using data for a single year affects the results. The second examined whether including leases in the measure of investment affects the results. With respect to the first, similar results are obtained with either the 1975, 1976, or 1977 investment to sales ratio or sales to gross plant ratio. With respect to the second, if lease payments are included in the 1977 measure of investment, similar results are obtained with the 1977 investment to sales ratio ($t=3.05$).

[13] There are four cases where foreign income is negative and total income is positive and there is one case where foreign tax expense is negative and total tax expense is positive. Further, there are two (three) cases where foreign tax expense (foreign current taxes) is positive and domestic tax expense (domestic current taxes) is negative giving rise to *TXFT* (*TPFT*) values greater than unity.

If cases where *TXFT* is greater than unity are excluded from the logit analysis, *TXFT* becomes significant at the .05 level. Similarly, if cases where *TPFT* is greater than unity are excluded *TPFT* becomes significant at the .10 level. If cases where a specific variable takes on values either smaller than zero or greater than unity are excluded from the logit analyses, then *TXFT* becomes significant at the .05 level, *TPFT* becomes significant at the .10 level, and *IFT* is significant only at the .10 level.

[14] If *TXFT* and *TPFT* are set equal to one, in the cases excluded from the analyses for reasons reported in footnote 11, *TPFT* remains statistically insignificant but *TXFT* would be significant at the .05 level. Also, if the sales to gross plant ratio is used in place of the investment to sales ratio in the five analyses, the sales to gross plant ratio is significant at the .05 level using a one-tailed test in four of the analyses and is significant at the .10 level in one of the analyses.

[15] Since opportunities for tax planning might be related to which industry a firm belongs to, an indicator variable was added into the analyses for each industry (as measured by two-digit SIC numbers) in which there were ten or more firms. The procedure resulted in adding eight indicator variables. In each of the five logit analyses, an *F*-test indicates that industry is not significant at the .10 level.

TABLE 5

SUMMARY OF CROSS-SECTIONAL ANALYSIS OF SELECTION OF AFTER-TAX OR BEFORE-TAX BONUS PLANS USING LOGIT REGRESSION[1]

$$ATBT = a_0 + a_1 MULT + a_2 I/S + a_3 Sales$$

	Estimated Coefficients and t-*statistics*					
Measure used for MULT (n=Sample Size)	*Intercept*	MULT (+)	I/S (+)	Sales (?)	R^2[2]	*Chi-Square Test of Model (3 Degrees of Freedom)*
Foreign Sales/ Total Sales, after Intercompany Eliminations (*SFTA*) (n=165)	−2.30 (−5.60)***	1.34 (1.09)	12.89 (2.97)***	0.003 (2.86)***	16.4%	40.69 *Pr*<.001
Foreign Income/Total Income (*IFT*) (n=165)	−2.36 (−5.88)***	2.03 (1.68)**	12.61 (2.90)***	0.0003 (2.89)***	17.2%	42.32 *Pr*<.001
Intercompany Sales/ Total Sales after Intercompany Eliminations (*SINT*) (n=95)	−2.36 (−4.55)***	−0.35 (−0.10)	17.16 (2.87)***	0.0003 (2.59)***	23.1%	35.64 *Pr*<.001
Foreign Tax Expense/ Total Tax Expense (*TXFT*) (n=164)	−2.20 (−6.03)***	1.15 (1.55)*	11.21 (2.62)***	0.0002 (2.74)***	16.6%	40.68 *Pr*<.001
Current Portion of the Provision for Foreign Income Taxes/Total Current Portion of the Provision for Income Taxes (*TPFT*) (n=161)	−2.13 (−5.82)***	0.69 (1.07)	11.06 (2.56)***	0.0003 (2.80)***	15.3%	37.36 *Pr*<.001

[1] $ATBT=1$ if the firm uses an after-tax bonus plan and zero if the firm uses a before-tax bonus plan
I/S=the average of the 1975, 1976, and 1977 capital investment to sales ratio
$MULT$=a proxy for the degree to which firms are multinational (i.e., either *SFTA, IFT, SINT, TXFT,* or *TPFT*)

[2] The R^2 statistic is similar to the square of the multiple correlation coefficient in the normal setting, after adjusting for the number of parameters estimated.

* Significant at the .10 level (one-tailed test).

** Significant at the .05 level (one-tailed test).

*** Significant at the .01 level (one-tailed test for the coefficients of *MULT* and *I/S* and two-tailed test for the intercept and sales).

.05 level using a one-tailed t-test ($t=1.65$). The investment to sales ratio and sales are both significant at the .01 level.[16] These results are consistent with the two hypotheses.

IV. SUMMARY AND CONCLUSIONS

This paper presents a first step in establishing empirical evidence on why some firms use accounting profits before income taxes and other firms use accounting profits after income taxes when determining short-term bonuses for top executives. Two hypotheses are developed. The first is that the greater the degree to which firms are multinational, the more likely they are to use after-tax bonus plans. The second is that the more capital intensive firms are, the more likely they are to use after-tax bonus plans. Empirical results are weakly consistent with the first hypothesis and consistent with the second hypothesis.

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[16] If the principal component analysis is conducted using the five measures of degree to which firms are multinational, the overall measure is not significant at the .10 level using a one-tailed t-test ($t=1.12$). One contributing factor to the lack of significance is the reduction in the power of the test due to the smaller sample size.

The paper also found that the larger the firm is, the more likely the firm is to use an after-tax bonus plan. One explanation for this finding is that size is a proxy for the degree to which firms are multinational. Another potential explanation is that as a firm grows, more opportunities become available to the manager for tax planning. Also, there might exist economies of scale in tax planning.

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Unusual Patterns in Reported Earnings

Jacob K. Thomas

ABSTRACT: Carslaw [1988] provides evidence that New Zealand firms may round up earnings when they are just below reference points denoted by $N\times 10^k$. He observes more zeros and fewer nines than expected by chance in the second-from-left-most digit for a sample of reported earnings numbers. This study examines COMPUSTAT firms to determine whether reported earnings for U.S. firms follow similar patterns. It also reexamines the expectation model used by Carslaw. While U.S. earnings numbers deviate less from expectations, relative to Carslaw's sample, a number of other interesting patterns are observed. Firms reporting losses exhibit the opposite patterns (fewer zeros and more nines). Analysis of *quarterly* earnings data reveal similar, though considerably smaller, deviations from expected frequencies. Examination of *per share* earnings (EPS) suggests that rounding behavior is more prevalent in EPS numbers than it is in earnings numbers. Using an alternative model of expected frequencies, unusually high proportions of EPS numbers divisible by ten cents and five cents are observed for firms reporting profits, but no such deviations are observed for firms reporting losses. Again, quarterly EPS data exhibit the same patterns observed for annual EPS numbers.

CARSLAW [1988] documents unusual patterns in reported earnings of New Zealand firms. Specifically, there are more zeros and fewer nines than would be expected by chance, in the second-from-left-most digit. He interprets this evidence as being consistent with investors having cognitive reference points of $N\times 10^k$. Similar to the well-known "$1.99" pricing phenomenon, earnings of $1,900,000 may be perceived as being much lower than $2,000,000, relative to other $100,000 differences (say, between $2,100,000 and $2,000,000). Therefore, firms round-up earnings just below $N\times 10^k$ (with a nine in the second-from-left-most digit) and report earnings numbers that just exceed such reference points (with a zero in the second-from-left-most digit). This pattern is observed for both owner and manager-controlled domestic firms. The only group not exhibiting this pattern are firms controlled by foreign owners, for whom foreign currency denominated earnings could potentially be important.

Managers have incentives to round earnings for two general reasons; one relates to firm valuation and the other is based on the use of accounting numbers in various contracts. If reported earnings affect firm value as perceived by various

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financial statement users, and the \$1.99 phenomenon describes users' decision making, then small changes in reported earnings near user reference points have disproportionately large effects on perceived firm value. This framework, labelled the "firm valuation perspective" in this paper, is the one used by Carslaw. However, a second view, termed the "contractual parameter perspective," could also be relevant (see Watts and Zimmerman [1986]). If budgets or lending and compensation contracts are denominated in round earnings numbers, small changes around such contractual parameters may have large cash flow effects. While the former perspective relies on cognitive limitations of human decision makers, the latter only presumes that key contractual numbers are typically selected as round earnings numbers.

This study offers a preliminary investigation of the rounding of earnings phenomenon by extending Carslaw's paper in a number of ways. First, earnings for COMPUSTAT firms are examined to determine if the unusual patterns observed by Carslaw are peculiar to New Zealand firms. Second, losses are examined (Carslaw's sample excludes losses) to see whether there is a reversal of the pattern observed for the positive earnings sample. Third, firms are partitioned into positive and negative earnings change subsamples and subsamples based on industry membership. Fourth, quarterly earnings and, finally, earnings per share (EPS) data are examined.

The next section presents the empirical analysis, and the concluding section summarizes the results.

DATA ANALYSIS AND RESULTS

To determine whether observed occurrences of certain numbers in the second digit are unusual, expected proportions for each of the ten digits (zero to nine) need to be identified under the null hypothesis of no managerial efforts to round earnings numbers. Contrary to intuition, each of the ten numbers are not equally likely in the second digit for most collections of numerical data; zeros are observed more often by chance than nines, with observed proportions of other digits taking intermediate values. In fact, the expected distributions are even more skewed for the first digit. This anomaly was first documented by Newcomb [1881] and analyzed in greater detail by Benford [1938].[1] Benford postulated, in what has since become known as Benford's law, that the expected proportion of occurrence of the number x as the first digit, regardless of the source of the numerical data, can be approximated by the following relation:

$$\text{prob.}(x \text{ is the first digit}) = \text{Log}_{10}(x+1) - \text{Log}_{10}(x). \qquad (1)$$

Using the same logic, the expected proportion for x as the first digit and y as the second digit is

$$\text{Log}_{10}\left(x+\frac{y+1}{10}\right) - \text{Log}_{10}\left(x+\frac{y}{10}\right).$$

Summing over all possible x values for any value of y gives the expected overall proportion for y as the second digit:

$$\text{prob.}(y \text{ is the second digit}) = \sum_{x=1}^{9}\left(\text{Log}_{10}\left(x+\frac{y+1}{10}\right) - \text{Log}_{10}\left(x+\frac{y}{10}\right)\right). \qquad (2)$$

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[1] Tables of common logarithms often showed evidence of selective use of certain numbers; pages containing the logarithms of low numbers (one and two, for example) are apt to be more stained and frayed by use than those of higher numbers (eight and nine, for example). Fortunately, these patterns were observed before log tables were replaced by calculators!

Statisticians have since analyzed this proposition in great detail and continue to be puzzled by its descriptive validity (e.g., Raimi [1976]). While they have obtained necessary and sufficient conditions for Benford's law to hold, they are not certain why data in nature drawn from many different distributions, often appear to follow the law so well—especially combinations of data from disparate sources. However, Benford's law cannot be viewed as an exact description of empirical data. It is only an approximation that fits many tabulations of natural data. Moreover, as Benford discovered, there are some cases that do not follow the law at all.

Unfortunately, an exact formula for the distribution of first and second digits in the absence of managerial manipulation of reported earnings numbers is not easily obtained since the underlying distribution before any potential rounding is not publicly observed. Even if such a distribution were available, tedious calculations would be necessary to estimate the probabilities of occurrence by summing over relevant ranges of the underlying distribution. For example, the probability of observing a "1" as the first digit for firms reporting profits is the sum of the probabilities of observing the following intervals: [1,2)+[10,20)+[100,200), etc.

The probabilities generated by Benford's law offer an easier alternative. However, any inferences from comparisons of actual frequencies with those predicted by Benford's law are tentative, because the estimates are only approximate, and should be viewed with caution.

To determine whether the observed deviations from expected proportions are statistically significant, the normally distributed Z-statistic is used [Fleiss, 1981, p. 13]. That is:

$$Z=\frac{|p-p_0|-\frac{1}{2n}}{\sqrt{\frac{p_0(1-p_0)}{n}}} \tag{3}$$

where p and p_0 are the observed and expected proportions, respectively, and n is the sample size. The second term in the numerator is a continuity correction to bring normal and binomial probability curves into closer agreement, and should be applied only when it is numerically smaller than $|p-p_0|$.

Given the wide variation in sample sizes for different tests conducted here, comparing the statistical significance of unexpected deviations across samples may be misleading. Therefore, the magnitudes of observed deviations from expected proportions $(p-p_0)$, rather than Z-statistics or the associated probability level, are used for discussion of intersample comparisons.

Annual Earnings

Table 1 reports the distributions of first and second digits for annual earnings (before extraordinary items and discontinued operations) for all firm-years on the 1986 editions of the Annual Industrial and OTC (over-the-counter) COMPUSTAT files. Distributions for the first (second) digit are represented in the last column (row). The first number in each cell reports the difference between the actual and expected proportion of the sample (expressed as a percent of the sample) for different permutations of first and second digits. The second number is the proportion expected by chance, based on Benford's law, and the bottom entry (italicized) is the Z-statistic. These Z-statistics, provided to assess statistical significance, reject the null hypothesis at the five (one) percent level if values reported exceed 1.96 (2.57).

TABLE 1

DISTRIBUTION OF FIRST AND SECOND DIGITS FOR ANNUAL EARNINGS BEFORE EXTRAORDINARY ITEMS AND DISCONTINUED OPERATIONS (ALL FIRMS ON 1986 EDITION OF COMPUSTAT ANNUAL INDUSTRIAL AND OTC FILES)

Panel A. Deviations from Expected Proportions (percent of sample) for Positive Earnings (*n*=68,738):[1]

First Digit	Second Digit										Total
	0	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	
1	0.31*	0.17*	0.07	0.04	0.09	0.10	−0.05	0.00	0.09	−0.18*	0.63*
	4.14	3.78	3.48	3.22	3.00	2.80	2.63	2.48	2.35	2.23	30.10
	4.08	*2.34*	*0.96*	*0.59*	*1.32*	*1.50*	*0.86*	*0.03*	*1.50*	*3.22*	*3.57*
2	0.09	−0.07	0.03	0.05	−0.13*	−0.09	0.01	−0.02	−0.14*	−0.08	−0.36*
	2.12	2.02	1.93	1.85	1.77	1.70	1.64	1.58	1.52	1.47	17.61
	1.62	*1.25*	*0.49*	*0.91*	*2.52*	*1.90*	*0.15*	*0.34*	*2.99*	*1.79*	*2.47*
3	0.14*	0.03	−0.11*	0.01	−0.06	0.01	−0.13*	0.01	−0.03	−0.11*	−0.25
	1.42	1.38	1.34	1.30	1.26	1.22	1.19	1.16	1.13	1.10	12.49
	3.08	*0.55*	*2.50*	*0.25*	*1.36*	*0.12*	*3.08*	*0.30*	*0.72*	*2.86*	*1.94*
4	0.08*	−0.04	−0.01	−0.01	−0.02	−0.01	0.09*	−0.02	−0.02	−0.09*	−0.05
	1.07	1.05	1.02	1.00	0.98	0.95	0.93	0.91	0.90	0.88	9.69
	2.12	*0.89*	*0.30*	*0.38*	*0.52*	*0.38*	*2.44*	*0.48*	*0.53*	*2.40*	*0.41*
5	0.14*	0.04	0.04	−0.02	0.03	0.04	−0.05	0.02	−0.07*	−0.11*	0.06
	0.86	0.84	0.83	0.81	0.80	0.78	0.77	0.76	0.74	0.73	7.92
	3.90	*0.99*	*1.22*	*0.53*	*0.85*	*1.11*	*1.39*	*0.63*	*2.21*	*3.28*	*0.56*
6	0.09*	0.00	−0.08*	0.09*	0.08*	−0.03	−0.01	−0.02	−0.03	−0.02	0.07
	0.72	0.71	0.69	0.68	0.67	0.66	0.65	0.64	0.63	0.62	6.69
	2.71	*0.04*	*2.39*	*2.70*	*2.55*	*0.95*	*0.45*	*0.51*	*0.88*	*0.53*	*0.73*
7	0.06	0.04	−0.03	−0.05	−0.03	0.03	0.01	0.03	0.02	−0.08*	0.01
	0.62	0.61	0.60	0.59	0.58	0.58	0.57	0.56	0.55	0.55	5.80
	1.85	*1.32*	*0.95*	*1.53*	*0.91*	*0.96*	*0.47*	*1.04*	*0.83*	*2.74*	*0.15*
8	0.13*	0.01	−0.03	−0.01	−0.04	−0.02	−0.01	−0.01	0.01	−0.01	0.03
	0.54	0.53	0.53	0.52	0.51	0.51	0.50	0.50	0.49	0.49	5.12
	4.51	*0.38*	*0.97*	*0.21*	*1.48*	*0.73*	*0.25*	*0.47*	*0.50*	*0.17*	*0.35*
9	0.06*	−0.05	0.00	0.02	−0.01	0.00	−0.04	0.02	−0.05*	−0.09*	−0.15
	0.48	0.47	0.47	0.46	0.46	0.45	0.45	0.45	0.44	0.44	4.58
	2.19	*1.98*	*−0.01*	*0.69*	*0.25*	*0.03*	*1.64*	*0.76*	*2.05*	*3.44*	*1.82*
Total	1.09*	0.12	−0.12	0.12	−0.09	0.01	−0.18	0.02	−0.22*	−0.76*	0.00
	11.97	11.39	10.88	10.43	10.03	9.67	9.34	9.04	8.76	8.50	100.00
	8.81	*1.02*	*0.99*	*1.00*	*0.74*	*0.05*	*1.62*	*0.20*	*2.01*	*7.14*	

TABLE 1—*Continued*

Panel B. Deviations from Expected Proportions (percent of sample) for Negative Earnings (n=11,359):[1]

First Digit	Second Digit *0*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*Total*
1	−0.27* 4.14 *3.49*	0.13 3.78 *1.78*	−0.04 3.48 *0.60*	0.03 3.22 *0.44*	0.07 3.00 *1.02*	−0.04 2.80 *0.60*	−0.04 2.63 *0.72*	−0.05 2.48 *0.87*	0.06 2.35 *1.10*	0.00 2.23 *0.01*	−0.15 30.10 *0.87*
2	−0.08 2.12 *1.38*	−0.26* 2.02 *4.82*	0.03 1.93 *0.61*	0.12* 1.85 *2.39*	−0.04 1.77 *0.75*	−0.20* 1.70 *4.17*	−0.15* 1.64 *3.11*	−0.20* 1.58 *4.13*	0.12* 1.52 *2.60*	0.17* 1.47 *3.58*	−0.49* 17.61 *3.34*
3	−0.23* 1.42 *5.00*	0.03 1.38 *0.65*	0.06 1.34 *1.43*	0.19* 1.30 *4.42*	0.21* 1.26 *4.95*	0.02 1.22 *0.41*	0.05 1.19 *1.22*	0.04 1.16 *0.94*	0.27* 1.13 *6.73*	0.03 1.10 *0.67*	0.68* 12.49 *5.36*
4	0.01 1.07 *0.25*	0.23* 1.05 *5.91*	0.03 1.02 *0.88*	0.01 1.00 *0.35*	0.09* 0.98 *2.36*	0.06 0.95 *1.54*	0.00 0.93 *0.00*	−0.08* 0.91 *2.13*	0.01 0.90 *0.29*	0.28* 0.88 *7.74*	0.64* 9.69 *5.70*
5	−0.09* 0.86 *2.65*	−0.19* 0.84 *5.48*	−0.04 0.83 *1.24*	−0.08* 0.81 *2.35*	0.06 0.80 *1.66*	−0.01 0.78 *0.21*	−0.24* 0.77 *7.20*	−0.09* 0.76 *2.59*	−0.06 0.74 *1.68*	0.17* 0.73 *5.15*	−0.58* 7.92 *5.58*
6	0.08* 0.72 *2.56*	−0.08* 0.71 *2.52*	−0.15* 0.69 *4.68*	−0.01 0.68 *0.17*	−0.02 0.67 *0.68*	−0.06 0.66 *1.77*	0.04 0.65 *1.36*	−0.07* 0.64 *2.31*	0.07* 0.63 *2.30*	−0.03 0.62 *0.85*	−0.22* 6.69 *2.25*
7	−0.03 0.62 *0.85*	0.15* 0.61 *5.03*	0.04 0.60 *1.46*	−0.14* 0.59 *4.83*	0.02 0.58 *0.82*	−0.04 0.58 *1.30*	−0.03 0.57 *1.05*	0.02 0.56 *0.70*	0.04 0.55 *1.27*	0.01 0.55 *0.27*	0.05 5.80 *0.51*
8	−0.04 0.54 *1.32*	−0.06* 0.53 *2.04*	−0.05 0.53 *1.82*	0.02 0.52 *0.59*	0.08* 0.51 *3.08*	0.04 0.51 *1.37*	0.01 0.50 *0.29*	0.04 0.50 *1.49*	0.00 0.49 *0.06*	0.18* 0.49 *6.91*	0.23* 5.12 *2.71*
9	0.05 0.48 *1.81*	−0.01 0.47 *0.28*	−0.09* 0.47 *3.46*	−0.09* 0.46 *3.29*	−0.09* 0.46 *3.45*	0.03 0.45 *1.15*	−0.06* 0.45 *2.43*	0.01 0.45 *0.46*	−0.05* 0.44 *2.09*	0.14* 0.44 *5.37*	−0.17* 4.58 *2.06*
Total	−0.58 11.97 *1.91*	−0.06 11.39 *0.18*	−0.20 10.88 *0.68*	0.06 10.43 *0.20*	0.38 10.03 *1.35*	−0.20 9.67 *0.72*	−0.43 9.34 *1.55*	−0.37 9.04 *1.37*	0.47 8.76 *1.75*	0.94* 8.50 *3.57*	0.00 100.00

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[1] The other two numbers in each cell report the expected proportions, and a Z-statistic (in italics). Expected proportions are adapted from Benford [1938]. Z-statistics, based on Fleiss [1981], are used to determine if reported deviations from expected proportions are statistically significant. Scores exceeding 1.96 (2.57) are significant at the five percent (one percent) level. Deviations significantly different from zero at the five percent level (two-tailed test) are identified by *.

Note that the earnings numbers from COMPUSTAT are occasionally different from the initial announcements, for at least two reasons. First, both annual and quarterly announced earnings could change before they are finally reported in the financial statements. Second, quarterly EPS numbers are adjusted by COMPUSTAT in the year of and the year prior to a business combination. Therefore, if managers focus on the initial announcements when deciding to round reported earnings, any errors in measurement caused by using COMPUSTAT data bias the tests against observing rounded earnings numbers.

Panel A provides results for the subsample reporting profits. The bottom row indicates that the proportion of zeros (nines), expected to be 11.97 (8.5) percent of the sample, is actually higher (lower) by 1.09 (0.76) percent of the sample. The corresponding deviations reported by Carslaw are +4.5 and −2.1 percent for zeros and nines, respectively. Despite the higher Z-statistics, the magnitudes observed for U.S. firms are approximately one-fourth and one-third of those observed for zeros and nines in the New Zealand sample, respectively.

Is rounding limited to cases with nines in the second digit? The fact that the positive deviations for zeros are not completely offset by negative deviations for nines indicates that rounding to zero might also occur from second digits other than nine. Specifically, the negative deviation observed for eights, statistically significant at the five percent level, indicates that rounding to zero may also occur when the second digit is eight.

The discussion so far assumed that rounding is independent of the first digit. The distributions of *first* digits in panel A (the right-most column) indicate, however, that ones are observed more frequently than expected, and the numbers two, three, and nine are observed less often than expected. (The Z-statistics for three and nine are only significant at the ten percent level.) Clearly, firms appear more likely to round to just above 1×10^k (more ones than expected in the first digit). The patterns observed for two, three, and nine indicate that firms are more likely to round when the first digit is one of these numbers than they are to round to a number that has a two, three, or a nine as the first digit.

Examination of individual cells in Table 1 reveals that large deviations, that are statistically significant at the five percent level, are confined primarily to the columns for zero and nine as the second digit. Earnings just exceeding 10^k (with one and zero as the first and second digits, respectively) are unusually frequent in this sample, as indicated by the deviation of 0.31 reported in the first cell. Carslaw observes similar patterns. In contrast, earnings just below 10^k (with nine and nine as the first and second digits, respectively) occur less often than expected. Note that although twos, threes, and nines occur less frequently than expected as first digits, they occur more often than expected with zero as the second digit.

In summary, the results in panel A of Table 1 confirm Carslaw's findings on the U.S. sample: fewer nines and more zeros than expected by chance alone are observed in the second digits of reported annual earnings. This evidence is consistent with the view that firms round *up* earnings from just below $N \times 10^k$ (second digit$=9$) to just above $N \times 10^k$ (second digit$=0$). However, evidence of rounding in larger increments also exists. First, the positive deviation for zero as the second digit exceeds the negative deviation for nine as the second digit. Second, the positive deviation for N as the first digit and zero as the second digit (just above $N \times 10^k$) is considerably different from the negative deviation for $N-1$ as the first digit and nine as the second digit (just below $N \times 10^k$). This asymmetry is most pronounced when N equals one (and $N-1$ is nine, since zero is not an allowable first digit).

This evidence is also consistent with firms rounding *down* from just below $N \times 10^k$ (second digit $=9$) to just above $N-1 \times 10^k$ (second digit $=0$), or rounding down in larger increments as discussed above. However, rounding down appears less plausible than rounding up for much of the evidence, especially given that rounding occurs most frequently from nine as the second digit. Rounding down appears to be a more plausible explanation for the negative deviations observed for two and three as the first digit.

For the subsample reporting losses, panel B documents a reversal of the unusual pattern observed in panel A: there are more nines and fewer zeros than expected in the second digit. The magnitudes of observed deviations from expected proportions indicate that rounding behavior (avoiding round numbers for losses and moving to round numbers for profits) is less prevalent for losses than it is for profits. The unexpected increase (decrease) in zeros (nines) observed in panel A exceeds the unexpected increase (decrease) in nines (zeros) observed in panel B. Overall, in contrast with the higher frequency of round numbers observed for profits, firms appear to avoid round figures when reporting losses and prefer to report losses that are just below $-N \times 10^k$ (in absolute magnitude).

If the expected frequencies used in Table 1 are incorrect, the inferences made so far may be unwarranted. However, similar qualitative conclusions can be made by assuming that the true (but unknown) expectation model is the same for both positive and negative earnings. Comparing the observed frequencies for profit and loss subsamples, instead of comparing observed frequencies with frequencies predicted by Benford's law, suggests that earnings numbers are rounded. Further, some confirmation is obtained that the expected frequencies based on Benford's law are not grossly inappropriate, since the observed frequencies for the profit and loss samples deviate from it in *opposite* directions.

Table 2 presents partitions of the annual earnings sample to determine whether certain firms are more likely than others to exhibit such patterns; i.e., cross-sectional variation in rounding behavior. Panel A investigates "good" and "bad" news portfolios representing firm years with current earnings being greater than and less than the prior year's earnings, respectively. This partition assumes that earnings follow a simple random walk model. To the extent this model is not representative of the data, the tests are less likely to detect differences between the two partitions. For brevity, only the digits zero, five, and nine are reported. Based on the magnitudes of unexpected deviations, bad news firm-years have more zeros than expected for positive earnings and more nines than expected for losses, relative to the good news subsample. The perceived benefits of rounding appear to be higher for bad news announcements (experiencing earnings decreases).

Panel B offers results from a similar investigation based on industry partitions as suggested by Sharpe [1982]. While the patterns observed for the overall sample appear to be repeated for each industry subsample, two minor inter-industry differences, based on the mag-

TABLE 2

DEVIATIONS FROM EXPECTED PROPORTIONS FOR SECOND DIGIT OF ANNUAL EARNINGS BEFORE EXTRAORDINARY ITEMS AND DISCONTINUED OPERATIONS[1]
(ALL FIRMS ON 1986 EDITION OF COMPUSTAT ANNUAL INDUSTRIAL AND OTC FILES)

Panel A. Partitions Based on Unexpected Earnings:

Earnings Sign	*Positive*			*Negative*		
Second Digit	*0*	*5*	*9*	*0*	*5*	*9*
Expected Proportion (percent of sample)	11.97	9.67	8.50	11.97	9.67	8.50
Good News	0.90	0.03	−0.80*	−0.93	−0.72	0.15
(*n*=44,605 and 3,018)	*5.87*	*0.18*	*6.06*	*1.55*	*1.31*	*0.26*
Bad News	1.26*	−0.07	−0.63*	−0.56	−0.03	1.38*
(*n*=19,286 and 7,512)	*5.40*	*0.32*	*3.14*	*1.48*	*0.07*	*4.26*

Panel B. Partitions Based on Industry Membership:

Earnings Sign	*Positive*			*Negative*		
Second Digit	*0*	*5*	*9*	*0*	*5*	*9*
Expected Proportion (percent of sample)	11.97	9.67	8.50	11.97	9.67	8.50
Basic	0.52	−0.46	−1.46*	0.29	−2.09	2.63*
(*n*=4,756 and 620)	*1.09*	*1.04*	*3.57*	*0.16*	*1.69*	*2.28*
Capital	0.98*	−0.05	−0.52*	−0.73	0.37	0.42
(*n*=13,811 and 2,759)	*3.53*	*0.19*	*2.18*	*1.15*	*0.63*	*0.75*
Construction	2.98*	0.87	−1.48*	−1.12	0.58	1.16
(*n*=3,178 and 673)	*5.15*	*1.64*	*2.97*	*0.84*	*0.45*	*0.90*
Consumer	1.08*	0.06	−0.81*	−0.27	−0.07	0.89*
(*n*=28,350 and 4,420)	*5.57*	*0.77*	*4.88*	*0.53*	*0.14*	*2.09*
Energy	0.62	0.46	−0.90	−1.54	−1.60	1.50
(*n*=3,170 and 970)	*1.05*	*0.84*	*1.78*	*1.39*	*1.60*	*1.58*
Finance	1.14*	−0.10	0.19*	−0.55	−0.01	0.67
(*n*=8,035 and 1,287)	*3.12*	*0.28*	*2.46*	*0.56*	*0.01*	*0.87*
Transportation	1.62*	−0.65	−0.28	−1.50	0.96	1.38
(*n*=2,905 and 602)	*2.71*	*1.18*	*0.46*	*1.07*	*0.73*	*1.12*
Utilities	0.70	0.06	0.15	2.73	−6.73	1.79
(*n*=4,443 and 68)	*1.42*	*0.10*	*0.33*	*0.51*	*1.67*	*0.31*

[1] Deviations are expressed as percent of sample. Expected proportions are adapted from Benford [1938]. *Z*-statistics (in italics), based on Fleiss [1981], are used to determine if reported deviations from expected proportions are statistically significant. Scores exceeding 1.96 (2.57) are significant at the five percent (one percent) level. Deviations significantly different from zero at the five percent level (two-tailed test) are identified by *.

nitudes of deviations, can be discerned. The construction industry appears to have the largest unexpected deviations and the utilities (especially, the positive earnings subsample) exhibit the smallest deviations. These inter-industry differences may be due to differences in the ability to manipulate earnings or due to differences in the perceived benefits of rounding.

Quarterly Earnings

All firm-quarters on the quarterly COMPUSTAT file with available data for earnings before extraordinary items and discontinued operations are collected to form a quarterly earnings sample. Table 3 reports distributions of second digits for positive and negative earnings subsamples for each quarter and for all quarters combined. While the patterns observed for annual earnings are repeated here, the magnitudes of deviations from expected proportions are smaller. For positive earnings firm-quarters, the proportions of zeros are significantly greater than expected. The proportions of nines, however, are not significantly different from their expectation. To the extent that firms also seek to round annual earnings or semi-annual earnings, the amount of rounding observed in the second and fourth quarters should be less than that observed for the other two quarters. Some evidence consistent with this view is provided by the fact that the deviations for zeros are marginally higher for the first and third quarters. For firm-quarters with losses, many of the deviations are not in the direction suggested by the arguments here, and only one statistically significant deviation is observed.

Earnings Per Share

Earnings per share (EPS) are related to total earnings but management has some ability independently to round both numbers. Therefore, primary EPS as reported by COMPUSTAT for the annual earnings and quarterly earnings samples described earlier are examined to identify any unusual patterns.

Repeating the analysis in Tables 1 and 3 indicates that analyzing second digits and using Benford's law for expected frequencies might both be inappropriate for EPS numbers. Deviations from expectations for first, second, and even third digits appear to follow patterns that are considerably different from those reported earlier, and the opposite patterns for profit and loss subsamples reported earlier are no longer observed. Two potential explanations for these results are as follows. First, the unusually high occurrences of fives and zeros in the third digit indicate that the last digit, rather than the second digit, is used as a reference point for EPS numbers. Second, per share earnings between −10¢ and 10¢ do not report a second digit. Since about seven percent of the annual EPS distribution (and approximately four times as much of the quarterly EPS distribution analyzed later) lies between these limits, the extent of any potential bias caused by omitting these announcements remains indeterminate.

To understand better the nature of any potential rounding of EPS numbers, histograms for the number of firm-years reporting EPS equal to 1¢, 2¢, etc., for annual and quarterly EPS data, were examined. These histograms reveal frequent occurrences of EPS numbers that are multiples of 10¢. Multiples of 5¢ (especially multiples of 25¢) also appeared more frequently than other EPS numbers. Figure 1 provides a partial view of the histogram obtained for annual EPS data. In panel A, the higher proportions of multiples of 5¢ and 10¢, relative to adjacent EPS numbers, for the subsample reporting profits is clearly evident. Note, however, that the frequency for EPS=$1.00 is not higher than the frequency observed for $1.01. This curious departure from the systematic patterns observed for all other multiples of 5¢ and 10¢ is repeated for higher EPS multiples of $1.00. Perhaps, managers view rounding to these numbers as being too obvious and less credible. The histograms in panel B reveal no such patterns for the subsample reporting losses.

TABLE 3

DEVIATIONS FROM EXPECTED PROPORTIONS FOR SECOND DIGIT OF QUARTERLY EARNINGS BEFORE EXTRAORDINARY ITEMS AND DISCONTINUED OPERATIONS[1]

(All Firms on 1986 Edition of COMPUSTAT Quarterly File)

Second Digit		*0*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
Expected Proportions (percent of sample)		11.97	11.39	10.88	10.43	10.03	9.67	9.34	9.04	8.76	8.50
Positive Earnings	1st Quarter (*n*=14,844)	0.66* *2.51*	0.32 *1.23*	0.01 *0.04*	−0.17 *0.69*	−0.34 *1.37*	0.08 *0.32*	−0.49* *2.06*	0.23 *0.96*	−0.02 *0.08*	−0.28 *1.22*
	2nd Quarter (*n*=15,168)	0.45 *1.72*	0.18 *0.69*	−0.40 *1.61*	−0.21 *0.88*	−0.04 *0.15*	−0.20 *0.82*	−0.11 *0.46*	0.50* *2.17*	−0.32 *1.39*	0.16 *0.69*
	3rd Quarter (*n*=16,016)	0.52* *2.05*	0.04 *0.15*	0.14 *0.57*	−0.26 *1.06*	−0.15 *0.63*	0.07 *0.31*	−0.30 *1.31*	−0.04 *0.16*	0.21 *0.94*	−0.24 *1.10*
	4th Quarter (*n*=15,683)	0.48 *1.86*	−0.10 *0.40*	−0.26 *1.03*	0.42 *1.71*	0.22 *0.92*	−0.25 *1.06*	0.11 *0.47*	−0.64* *2.83*	0.41 *1.81*	−0.38 *1.72*
	Combined (*n*=61,711)	0.53* *4.09*	0.10 *0.83*	−0.12 *1.00*	−0.06 *0.46*	−0.07 *0.62*	−0.07 *0.62*	−0.19 *1.67*	0.00 *0.03*	0.07 *0.65*	−0.19 *1.69*
Negative Earnings	1st Quarter (*n*=1,736)	0.29 *0.36*	−0.42 *0.55*	−0.33 *0.43*	−0.86* *2.00*	1.25 *1.79*	0.68 *0.98*	−0.17 *0.22*	0.08 *0.08*	−0.11 *0.13*	−0.42 *0.62*
	2nd Quarter (*n*=1,487)	−0.51 *0.60*	−0.11 *0.11*	0.27 *0.31*	−0.51 *0.63*	−0.88 *1.14*	0.32 *0.40*	−0.82 *1.10*	0.95 *1.30*	−0.79 *1.09*	0.32 *0.42*
	3rd Quarter (*n*=1,761)	−0.34 *0.42*	0.45 *0.59*	0.60 *0.81*	−1.35 *1.92*	−0.23 *0.31*	−0.69 *0.99*	−0.56 *0.81*	0.00 *0.01*	0.27 *0.39*	1.86* *2.91*
	4th Quarter (*n*=2,233)	1.03 *1.53*	−0.06 *0.05*	−0.26 *0.37*	0.03 *0.01*	−0.66 *1.04*	0.46 *0.72*	−0.30 *0.46*	0.30 *0.47*	0.33 *0.53*	−0.87 *1.50*
	Combined (*n*=7,217)	0.19 *0.52*	−0.03 *0.07*	0.05 *0.11*	−0.64 *1.85*	0.23 *0.66*	0.20 *0.59*	−0.44 *1.32*	0.30 *0.93*	−0.02 *0.05*	0.16 *0.49*

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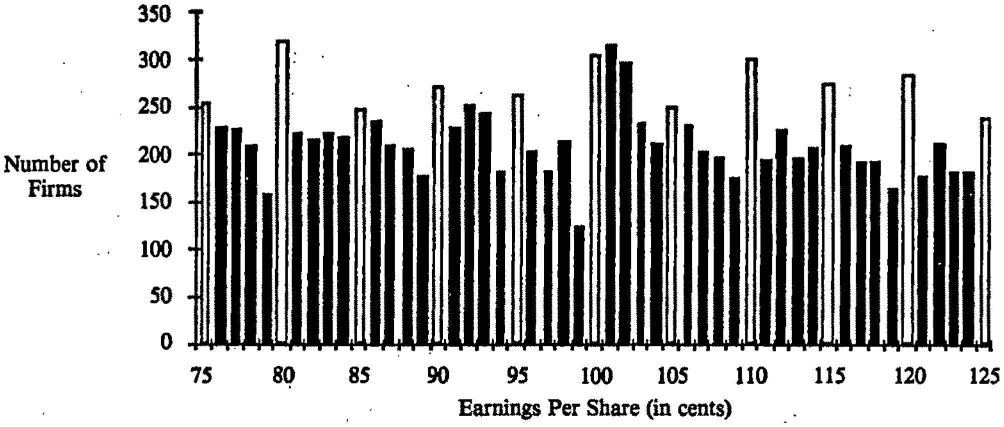
[1] Deviations are expressed as percent of sample. Expected proportions are adapted from Benford [1938]. *Z*-statistics (in italics), based on Fleiss [1981], are used to determine if reported deviations from expected proportions are statistically significant. Scores exceeding 1.96 (2.57) are significant at the five percent (one percent) level. Deviations significantly different from zero at the five percent level (two-tailed test) are identified by *.

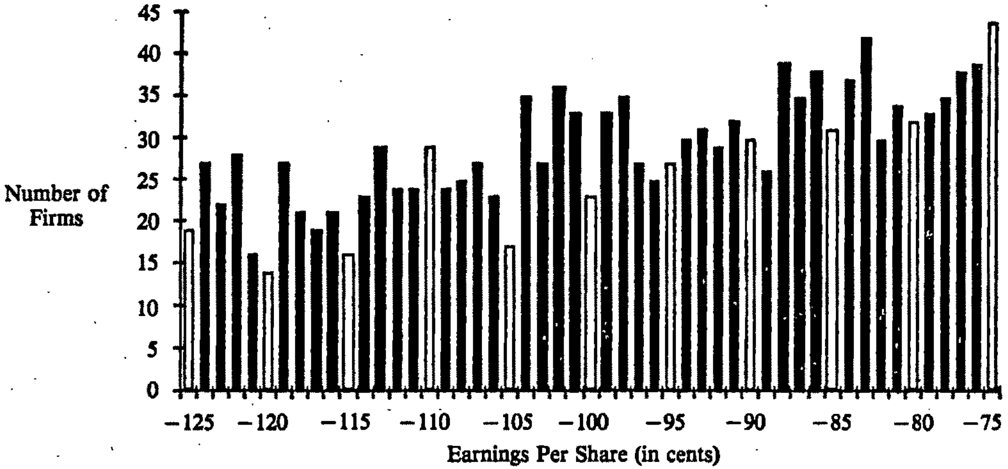
FIGURE 1

DISTRIBUTION OF ANNUAL PRIMARY EARNINGS PER SHARE BEFORE EXTRAORDINARY ITEMS AND DISCONTINUED OPERATIONS FOR ALL COMPUSTAT FIRMS

Panel A. Partial Distribution for Firms Reporting Profits:



Panel B. Partial Distribution for Firms Reporting Losses:



In fact, this portion of the distribution indicates that the frequency of EPS that are multiples of 5¢ and 10¢ are probably lower than frequencies for adjacent numbers. Similar patterns are observed in histograms for quarterly EPS numbers (not reported).

Based on this analysis, deviations from expected proportions for the right-most digit are analyzed; i.e., are the occurrences of zeros, fives, and nines as the right digit different from frequencies expected by chance? To obtain expected proportions (p_0) for each EPS value under the null hypothesis of no rounding in reported EPS numbers, an average of the *observed* proportions for adjacent EPS numbers is used. For example, the expected proportion for EPS = 12¢ is the mean of the observed proportions for 11¢ and 13¢. Note that this expectation model only assumes that the underlying distribution of EPS numbers *under the null hypothesis* be "smooth"; i.e., it can be approximated by a locally linear segment over a 2¢ range. This requirement is reasonable given the smooth overall distribution of reported EPS numbers observed in the histograms. Note that the earlier general concern about the approximate nature of Benford's law as well as the specific concern about its applicability to EPS data are both avoided by this alternative expectation model.

To allow statistical inferences, two test statistics are used to measure deviations from expected frequencies. The first computes percent deviations from expectations

$$\left(100\times\frac{p-p_0}{p_0}\right)$$

for each EPS number. The median value of these percent deviations are reported for each possible right digit. For example, the percent differences for 9¢, 19¢, 29¢, and so on are used to obtain a median percent deviation for EPS numbers with nine as the right digit. A signed rank test is used to determine if the median is significantly different from zero and the associated p-values are also reported. The second test computes Z-statistics (see eq. (3)) for each EPS value. These Zs are then squared and summed over EPS values with the same right digit to obtain a χ^2 statistic and the associated p-value. To reduce potential effects of extreme values, annual (quarterly) EPS numbers are limited to values between -2.00 and 5.00 (-1.00 to 2.00) since beyond these ranges the frequencies rapidly decline, thereby causing large variation in percent deviations. While the ranges selected are arbitrary, almost all of the observations (approximately 95 percent) are included within these limits.

Table 4, panel A reports results of this analysis for subsamples of positive and negative EPS annual numbers. Consistent with the results in Figure 1, zeros and fives (nines) are observed as the right digit more (less) frequently than expected. The median deviation is as high as 36 percent (of expected proportions) for zeros and almost 16 percent for fives. Also, the median deviation of -31 percent for nines suggests that they are observed considerably less frequently than expected. These large deviations indicate the presence of substantial rounding for EPS numbers, even greater than that observed for earnings numbers.

Unlike the results obtained for negative earnings numbers in Table 1, panel B, the high p-values observed for the negative EPS subgroup indicate no apparent desire to avoid round EPS numbers when reporting losses. While this result contradicts the partial distributions in panel B of Figure 1, examination of the EPS histogram over the entire loss range indicates that the Figure 1 patterns are peculiar to the particular portion of the range selected there.

The results in panel B indicate that similar patterns are observed for quarterly EPS numbers. While the magnitudes of unexpected deviations are smaller than those observed for annual EPS data in panel A, the median deviations are highly significant for both zero and nine as the right digit (except for the fourth quarter) and range between 12 and 21 percent (of expected proportions). Again, no unusual patterns are observed for negative EPS numbers.

TABLE 4

DISTRIBUTION OF RIGHT DIGIT FOR PRIMARY EARNINGS PER SHARE DATA BEFORE EXTRAORDINARY ITEMS AND DISCONTINUED OPERATIONS (ALL FIRMS ON 1986 COMPUSTAT ANNUAL INDUSTRIAL AND OTC FILES AND QUARTERLY FILE)

Panel A. Annual EPS—Between −$2.00 and $5.00 per share:

Right Digit		*0*	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
Positive Earnings (n=63,963)	Median[1] difference (percent)	36.39	−6.02	2.68	−4.97	−6.92	15.67	−3.65	−6.42	12.03	−30.74
	p-value	0.00	0.00	0.06	0.04	0.00	0.00	0.16	0.01	0.00	0.00
	χ^2 statistic[2]	1123.1	170.49	74.17	71.99	116.6	258.93	78.29	68.97	159.29	743.55
	p-value	0.00	0.00	0.01	0.02	0.00	0.00	0.01	0.04	0.00	0.00
Negative Earnings (n=9,425)	Median difference (percent)	3.90	−9.56	5.33	2.06	−5.96	−4.65	2.85	−0.21	−1.68	−0.75
	p-value	0.32	0.02	0.24	0.61	0.14	0.90	0.44	0.94	0.81	1.00
	χ^2 statistic	24.02	19.71	22.93	20.14	20.81	24.31	13.21	13.9	35.78	26.96
	p-value	0.24	0.48	0.29	0.45	0.41	0.23	0.87	0.84	0.02	0.14

TABLE 4—*Continued*

Panel B. Quarterly EPS—Between −$1.00 and $2.00 per share:

Quarter		I		II		III		IV	
Right Digit		*0*	*9*	*0*	*9*	*0*	*9*	*0*	*9*
Positive Earnings (n=59,815)	Median difference (percent)	21.41	−18.89	12.28	−15.08	12.83	−13.44	11.93	−6.78
	p-value	0.00	0.00	0.02	0.00	0.01	0.01	0.03	0.05
	χ^2 statistic	111.93	66.96	78.44	55.73	64.97	45.89	55.44	16.49
	p-value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.69
Negative Earnings (n=7,206)	Median difference (percent)	13.25	9.40	8.98	15.00	22.96	−20.19	−17.86	17.37
	p-value	0.55	0.54	0.47	0.80	0.14	0.08	0.36	0.19
	χ^2 statistic	5.79	4.37	6.93	10.31	13.61	13.46	15.03	17.11
	p-value	0.83	0.93	0.73	0.41	0.19	0.20	0.13	0.07

[1] The observed proportion (p) for each EPS value is compared with an expected proportion (p_o) to obtain the percent difference$=100\times\frac{p-p_o}{p_o}$. Expected proportions equal the mean of observed proportions for adjacent EPS values. The median percent difference is then computed for all EPS values with the same right digit. The p-value refers to a signed rank test of the null hypothesis that the median difference$=0$.

[2] Z-statistics are computed for each EPS value based on observed and expected frequencies. These Z-statistics are squared and summed over all EPS values with the same right digit to obtain the χ^2 statistic (and the associated p-value) reported in each cell.

SUMMARY

The results document evidence that managers of U.S. firms on COMPUSTAT reporting profits appear to round earnings numbers occasionally, confirming that similar patterns observed by Carslaw [1988] are not peculiar to New Zealand firms. These unusual patterns are observed at both the total earnings and per share levels for both annual and quarterly earnings. Evidence of rounding is particularly apparent at the *per share* level, with multiples of 5¢ and 10¢ being observed considerably more often than other numbers. Firms reporting losses, on the other hand, appear to avoid round earnings numbers (observed primarily for annual earnings data).

Why do managers manipulate earnings this way? Carslaw argues that the $1.99 pricing phenomenon describes managers' perceptions of how stock is valued, and small changes in reported earnings near user reference points have large effects on firm value. Another explanation offered here is that budgets or lending and compensation contracts are denominated in round earnings numbers. The evidence on rounding of certain earnings numbers (such as per share earnings, quarterly earnings, and negative earnings) that are unlikely to be included as parameters in budgets and other contracts suggests that the latter explanation alone is unlikely to explain all rounding behavior. Whether managers' perceptions about the relevance of the $1.99 phenomena are valid and actually influence stock prices or whether rounding is a harmless practice of the Miller [1977] neutral mutation variety are issues that remain to be explored.

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SMALL SAMPLE STUDIES

M. Edgar Barrett, Editor

The Role of Debt Covenants in Assessing the Economic Consequences of Limiting Capitalization of Exploration Costs

Carol A. Frost and Victor L. Bernard

ABSTRACT: Several studies have hypothesized that economic consequences of mandated accounting procedures arise through impacts on firms' accounting-based loan covenants. However, this research has involved very little direct examination of the loan contracts. This study directly examines how public and private loan agreements were affected by an accounting procedure mandated by the SEC. It analyzes 24 loan agreements of 18 oil and gas firms that, as a result of an SEC requirement announced on May 6, 1986, recorded writeoffs of exploration costs for the first quarter of 1986. The principal finding is that, even for a mandated accounting procedure that caused both large financial statement differences and some technical violations of loan covenants, there were no observable economic consequences for the affected firms. This result casts doubt on the importance of economic consequences of other mandated accounting procedures that might operate through effects on debt covenants.

MUCH accounting research of the past decade has focused on the economic consequences of accounting procedures mandated by standard-setting bodies such as the SEC, the FASB, and the APB. It is hypothesized that these mandated procedures have potential stock price consequences through their effects on firms' accounting-based contracts, particularly loan covenants.

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Mandated accounting procedures may affect loan agreements by reducing or eliminating "slack" in accounting-based covenants ("slack" being defined as the nearness to restrictions imposed by loan covenants). The reduction of slack can lead to two types of negative economic consequences. First, the probability of technical default increases, potentially precipitating renegotiation or refinancing of the loan on less favorable terms. Second, in order to restore slack, managers may adopt investment, financing, or accounting policies that would not otherwise be optimal.

Evidence of economic consequences operating through debt covenants has usually been weak. However, the evidence is difficult to interpret, both in studies that find indications of such consequences (e.g., Lys [1984]), and in studies that do not (e.g., Salatka [1989]). One reason is that researchers have not gone beyond readily-accessible stock price and financial statement data to directly examine the debt contracts supposedly affected by the mandated accounting procedure.[1]

This study directly investigates how public and private loan agreements were affected by a ruling of the SEC in May, 1986, that limited capitalization of exploration costs by full cost oil and gas firms. The SEC ruling was selected because it (1) was purported to have large negative financial statement effects for many firms, (2) was unexpected, (3) was issued *after* the close of the fiscal period to which it applied (but prior to the release of financial statements) and, therefore, too late for firms to alter operating and financing decisions in order to mitigate its impact. If we cannot detect any effects of this SEC ruling, there should be doubt concerning whether other mandated accounting procedures might adversely affect firms through their impact on debt covenant slack.

Under the full cost method, oil and gas exploration companies are often permitted to capitalize exploration costs even when exploration leads to a dry hole. These capitalized costs cannot exceed a ceiling that depends on the estimated present value of proved oil and gas reserves. The constraint imposed by this ceiling was substantially "tightened" in the first quarter of 1986, when oil prices plummeted from $26/bbl. to $14/bbl.

In April 1986, the Office of the Chief Accountant of the SEC recommended that firms be permitted to implement the ceiling rule based on the expected price at the end of the year, instead of recording writedowns on the basis of current oil prices. Firms that projected a rebound in oil prices could thus avoid all or part of the writedown in the first quarter; if prices were to rebound, there would be no writedown at all.

The SEC unexpectedly rejected the Office of the Chief Accountant's proposal in a meeting of the Commissioners held on May 6, 1986.[2] This decision was widely covered in the press, and was

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ments and suggestions made by Dean Crawford, Linda DeAngelo, Tom Lys, Eric Press, Tom Stober, and two anonymous reviewers.

[1] Some studies use leverage ratios and/or other variables based on financial statement numbers as proxies for nearness to debt covenant constraints. For example, Lys [1984] uses the debt-equity ratio and the variance in the value of the firm as indicators of the probability of default. However, even this approach is crude. There is no assurance that the debt agreements include accounting-based covenants, or that the covenants would be affected by the accounting change in question. Furthermore, with the exception of effects on the inventory of payable funds, Lys (and others) made no direct attempt to measure the impact of the accounting change on slack in the loan covenants. Press and Weintrop [1989] conclude that leverage levels are associated with nearness to debt covenant constraints for up to four of the five types of covenant examined, depending on the particular leverage measure studied. Duke and Hunt [1989] conclude that leverage levels are associated with three of the seven types of constraints studied. Their results are fairly consistent across seven types of leverage proxies examined.

labelled as a "shock" by *The Wall Street Journal* (May 7, 1986, pp. 1 and 4), and a "surprise" by *The New York Times* (May 7, 1986, p. 1 of business section) and *The Oil Daily* (May 8, 1986, p. 2). SEC Chairman John Shad acknowledged that some companies would "end up with negative net worth" as a result of the decision, and that "that may trigger loan defaults" (*The Wall Street Journal*, May 7, 1986, p. 4). As expected, first quarter reports issued in the following days did indeed include large writedowns, and some technical defaults were reported.[3] Since oil prices continued to fall through the second quarter of 1986, additional writedowns were then required.

The goal of this study is to assess the impact of the May 1986 SEC ruling on loan covenant slack and to determine whether any resulting changes in slack led to renegotiation or refinancing of loans, or to other consequences, for the affected firms. We seek to identify these economic consequences both directly, through examination of public and private loan agreements, and indirectly, by analyzing stock price behavior.

Overall, we find that there were few technical violations, and no apparent economic consequences for the affected firms, even for this mandated accounting procedure that produced large negative financial statement effects. Seven of the 24 loan agreements studied had no accounting-based covenants. Accounting-based covenants in ten others either were not affected by the SEC decision, or were already in technical violation. As a result, there was a reduction in loan covenant slack for only seven (29 percent) of the 24 loans in the sample and only two technical violations were solely attributable to the SEC decision. Even these extreme cases showed no apparent impact, because the creditors waived the covenants related to the violations. The apparently minimal economic consequences of the May 1986 SEC decision are corroborated by a failure of stock prices to decline, even for the firms whose loan agreements were most affected by the ruling.

The rest of the paper is organized as follows. Section I describes sample selection procedures and the stock price behavior of sample firms around the time of the SEC decision. Section II provides some descriptive evidence about the loan agreements, including the potential for them to be affected by the SEC decision. Section III discusses the impact of the SEC decision on loan covenant slack, the effects of technical violations, and the stock price behavior of that subset of firms whose loan covenants were most affected. Section IV presents some conclusions.

I. Description of Sample and Preliminary Stock Price Analysis

This study uses two samples, one of which is a subset of the other. The *initial sample* includes 80 oil and gas firms, and provides the basis for a preliminary analysis of the stock price reaction to the SEC decision. The *final sample* is the focus of the study of loan agreements; it includes 18 firms.

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[2] That the reversal was unexpected was confirmed in conversations with Gregg Jarrell, then Chief Economist of the SEC, and with a member of the Chief Accountant's staff. The reversal occurred at the urging of Jarrell, who argued that oil futures prices indicated no basis for expecting a rebound in oil prices.

[3] At least three companies reported that the writedown resulted in technical default on certain loan agreements [*The Oil Daily*, May 27, 1986, p. 1, and *The Wall Street Journal*, April 2, 1986, p. 13]. A fourth company reported that the writedown would have caused technical violation except that a waiver of its net worth requirement had already been negotiated [*The Wall Street Journal*, May 7, 1986, pp. 1 and 4].

The Initial Sample

The COMPUSTAT Primary, Secondary, Tertiary, and Full Coverage files (including OTC firms) were used to identify 383 firms whose two-digit SIC code is 13 (Oil and Gas Extraction). Daily stock prices were available for 198 of these firms from the Dow Jones Market Analyzer.[4]

The initial sample of 80 was obtained after the following deletions: (1) 46 firms whose fiscal years ended in March through June, because the May SEC decision to use current oil prices rather than projected end-of-fiscal year oil prices in calculating the writedown could have little effect on firms whose fiscal years were already completed, or near completion, (2) 20 nondomestic firms, (3) five firms that were not involved in oil and gas exploration during 1986, and (4) 47 firms with no trading activity on the day of the SEC decision (May 6, 1986). Some of these 47 firms (deleted in (4)) could have been retained if an event window were to be longer than one day. However, we chose not to do so because (1) we wanted to identify firms most likely to have been affected by the SEC decision, and lack of trading is a sign of no effect, and (2) a multi-day event window would involve potentially confounding events (to be discussed) on the day before and the day after the SEC decision.[5]

The initial sample of 80 firms includes 44 using the full cost method and 36 using the successful efforts method. Of the 44 full cost firms, 31 recorded writedowns in accordance with the procedure required by the May 6 SEC decision.

The Final Sample

The final sample consists of the 18 firms among the 31 full cost writedown firms (in the initial sample) for which public and/or private loan agreements could be obtained. Ideally, we would have selected the loan agreement for which the SEC decision imposed the greatest costs. However, since we could not make that determination in advance, and since the agreements are costly to analyze, we chose the available agreements bearing the largest dollar amount, assuming that the cost of technical violation is likely to be highest for such agreements.

Public debt issues were identified using *Moody's Bond Record* [1986], *Moody's Industrial Manual* [1986], and *Moody's OTC Industrial Manual* [1986]. Ten of the 31 full cost writedown firms had public debt outstanding throughout 1986. For nine of these ten firms, we obtained the bond indenture representing the largest possible dollar amount outstanding as of the 1985 fiscal year-end. The largest public debt issue for the other firm was less than 0.5 percent of total assets, and so we did not order the indenture for this issue.

Private loan agreements were identified for each firm by reviewing the 1986 Form 10-K Part IVs ("Exhibits, Finan-

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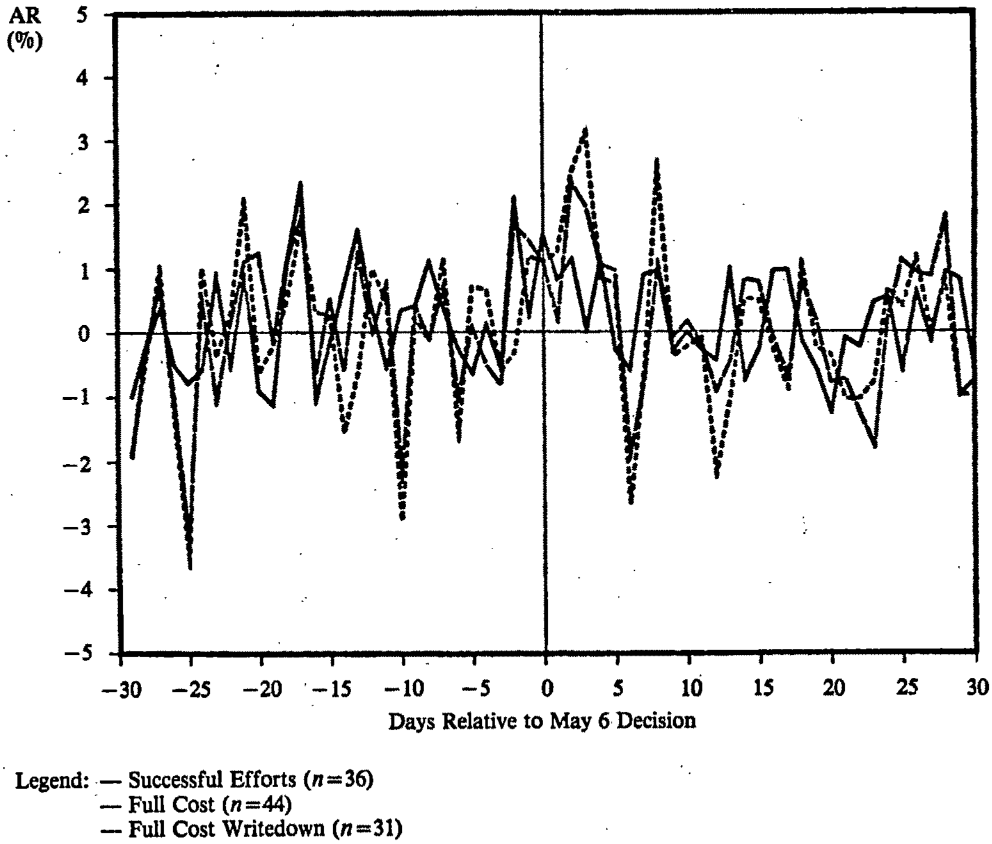
[4] The Market Analyzer provides historical stock quotes for securities listed on the New York, American, Pacific, and Midwest exchanges, as well as National Market and selected non-National Market NASDAQ securities.

[5] As we show later, the sample firms exhibit an overall upward drift in cumulative abnormal returns. If lack of trading is a sign of no change in value, it is possible that some negative influence (such as news of the SEC decision) led to a stock price effect which offset the positive drift observed for the sample. However, from April 25 through May 9, the market-adjusted returns for the 47 excluded firms average 4.0 percent (5.6 percent for the full cost firms; 3.1 percent for the successful efforts firms), which is comparable to that for firms retained in the sample. Furthermore, given the infrequent and light trading for the 47 excluded firms (no volume on the majority of days for the median firm) and their low stock prices (53 cents per share for the median firm), it is not clear that the returns data for these firms would be sufficiently reliable to include them in the event study. We thank Tom Lys for raising this issue.

FIGURE 1A
ABNORMAL RETURNS (AR) FOR FULL COST AND SUCCESSFUL EFFORTS PORTFOLIOS RELATIVE TO MAY 6, 1986



cial Statement Schedules, and Reports on Form 8-K"). Twenty of the 31 full cost writedown firms listed private loan agreements (dated on or before December 31, 1985) as exhibits to the Form 10-K. Loan agreements were available from our vendors (Bechtel Information Services and Disclosure Inc.) for 15 of the 20 firms; in each case we selected the largest available loan.

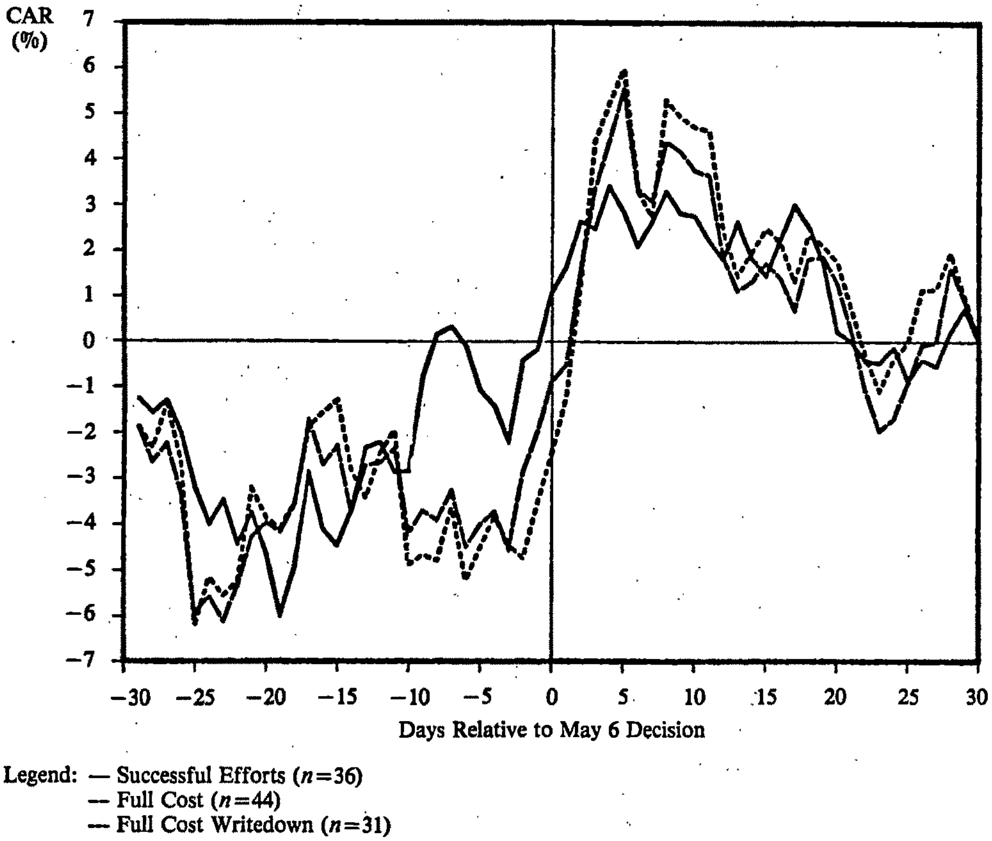
In summary, we obtained loan agreements for nine of the ten firms with public debt, and for 15 of the 20 firms that reportedly filed private loan agreements with the SEC. Because six firms belonged to both groups, the total number of firms in the final sample is 18.

Preliminary Stock Price Analysis

Figure 1a presents plots of abnormal returns (residuals from market model estimation of the returns equations over 60 days) for the portfolio of 36 successful efforts firms, the portfolio of 44 full cost firms, and the portfolio of 31 full cost writedown firms. Figure 1b presents plots of cumulative abnormal returns for the same three portfolios. If the SEC

FIGURE 1B

CUMULATIVE ABNORMAL RETURNS (CAR) FOR FULL COST AND SUCCESSFUL EFFORTS PORTFOLIOS RELATIVE TO MAY 6, 1986



decision had a negative impact on full cost writedown firms, the abnormal returns around May 6 would be lower for the full cost portfolios (or at least for the writedown portfolio) than for the successful efforts portfolio. However, a review of Figures 1a and 1b shows no such impact.

Statistical tests of significance confirm this conclusion. To test for a significant reaction, the following regression equation was estimated:

$$R_{FC\text{-}SE,t}=\alpha+\beta R_{MKT,t}+\eta X_t+\epsilon_t,$$

where $R_{FC\text{-}SE,t}$ is the return for day t on a portfolio with a long position in the 31 full-cost writedown firms and a short position in the 36 successful efforts firms and $R_{MKT,t}$ is the value-weighted return on the S&P 500 index for day t, and X_t is a 0/1 event indicator variable. The null hypothesis tested is H_0: $\eta=0$. The parameter associated with the May 6 event indicator variable was negative (−.002) but insignificant ($t=-.15$). Results were also insignificant when a May 7 event indicator variable was used instead, as well as when returns for all 44 full cost firms were included.

Even though there is no significant

difference between the behavior of full cost and successful efforts firms, there is a positive drift in the cumulative abnormal returns for both groups from day −2 (Friday, May 2) through day +4 (Monday, May 12). The drift may be attributable to the Senate Finance Committee's approval of the predecessor of the 1986 Tax Reform Act. The petroleum industry viewed this bill favorably, since it did little to change tax laws specific to oil and gas firms. A stock price response to the Finance Committee's action would be expected around day −1, as two influential members of the Committee pushed for exemption of the oil and gas industry from general restrictions on tax shelters [*The Wall Street Journal*, May 2, pp. 1, 3; and May 6, p. 3], and around day +1, as the news of the Committee's decision was made public. The final impediments to approval of the bill were removed late on the night of May 6 (day 0), after the close of trading.

Absent a confounding event that may have affected stock prices of oil and gas firms, this analysis gives no evidence that the full-cost writedown firms were more negatively affected during the period of the SEC decision than the successful efforts firms.[6]

II. DESCRIPTION OF THE LOAN AGREEMENTS AND COVENANTS

A mandated accounting procedure can have economic consequences through effects on loan covenant slack only if the loan agreements contain accounting-based covenants, and only then if the specific accounting variables contained in the covenants are affected. This section describes results of direct examination of the loan agreements in the final sample, and shows that most of them could be affected by the 1986 SEC decision on oil and gas accounting. It also presents evidence that complements the descriptions of accounting-based loan covenants in Leftwich [1983] and in Smith and Warner [1979], both of which rely principally on *Commentaries*, the standard reference manual used to draft debt agreements.

Types of Loan Agreements in the Sample

Thirteen of the 15 private loan agreements are bank borrowings; the other two are from non-bank financial institutions. The nine public loan agreements are all subordinated debentures. The private loan agreements are for shorter periods than the public loan agreements (five years vs. 15 years, on average); and 13 of the 15 private loans are secured, while none of the public debt issues are. Differences between public and private loan agreements noted later may reflect these underlying characteristics, rather than the public-private distinction as such.

Frequency of Use of Accounting Variables in Loan Covenants

Table 1 shows how many of the 24 loan agreements in the sample include accounting-based covenants. Some of the accounting variables used in these covenants are not calculated in accordance with GAAP, and are, therefore, less likely to be affected by regulations pertaining to GAAP. Thus, the agreements are classified according to whether they contain GAAP, "modified GAAP," and/or completely "non-GAAP" covenants.

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[6] A study conducted by the Office of the Chief Economist, U.S. Securities and Exchange Commission [1986] reached a similar conclusion. However, the SEC study was based on security price changes during windows ranging from one to several weeks. Rather than estimate a security returns regression model with the market return included as a regressor, the study examined net-of-market share price changes.

TABLE 1
USE OF GAAP, MODIFIED GAAP, AND NON-GAAP ACCOUNTING-BASED COVENANTS IN PUBLIC AND PRIVATE LOAN AGREEMENTS OF 18 OIL AND GAS FIRMS
(1986)

	Number of Loan Agreements		
	Private Debt	*Public Debt*	*Total*
GAAP Only	2	1	3
Both GAAP and Modified GAAP	4	1	5
Modified GAAP Only	2	2	4
Both Modified GAAP and Non-GAAP	1	2	3
GAAP, Modified GAAP, and Non-GAAP	2	0	2
At least one covenant based on GAAP or Modified GAAP	11	6	17
No Accounting-Based Covenants	4	3	7
Total Number of Loan Agreements	15	9	24

An accounting-based constraint is classified as "modified GAAP" if it uses GAAP-based numbers which are then adjusted. For example, the net worth covenant in Universal Resources' (private) credit agreement is classified as "modified GAAP" because it uses a net worth computation which excludes goodwill and other intangible assets, but otherwise follows GAAP. An accounting-based covenant is classified as "non-GAAP" if it uses a financial variable whose computation is totally independent of GAAP. All covenants in the sample classified as non-GAAP are based on the present value of oil and gas reserves.

Table 1 shows that 17 (71 percent) of the 24 debt contracts include accounting-based loan covenants. Such covenants occur about as frequently for private loans (11 of 15, or 73 percent) as for public debt (six of nine, or 67 percent).

Among contracts that include accounting-based covenants, Table 1 shows that eight (73 percent) of the private loan agreements and two (33 percent) of the public debt contracts contain covenants based on GAAP. At least one covenant classified as modified GAAP is found in nine (82 percent) of the private and five (83 percent) of the public debt contracts which contain accounting-based covenants. Covenants classified as non-GAAP appear in five loan agreements (three public and two private). Since the type of non-GAAP covenant appearing in our sample occurs only in extractive industries, our conclusion about the relative frequency of non-GAAP accounting-based loan covenants does not generalize to other types of industries.

The finding that most private loan agreements include "modified GAAP" covenants is consistent with Leftwich [1983]. In contrast, similar evidence in our sample concerning public debt is inconsistent with Smith and Warner [1979] and several later researchers who reference their study. While evidence from our small, nonrandom sample is only suggestive, it may be the only evidence gathered to date, as Smith and Warner's conclusions are not based on direct study of actual debt contracts.

In summary, Table 1 indicates that most loan agreements in the sample include accounting-based covenants, with at least one covenant in each of those agreements based on GAAP or modified GAAP. When private and public loan agreements are considered together, 15 of the 18 sample firms (83 percent) issued debt subject to accounting-based loan covenants. Thus, there is a strong indication that the loan agreements in the sample contain covenants that could be affected by a mandated accounting procedure.

Types of Accounting-Based Covenants

Table 2 describes the *types* of accounting-based covenants (affirmative or negative) found in the public and private loan agreements examined. We define an affirmative covenant as one that specifies limits (floors or ceilings) on accounting-based ratios, levels, or flows. When the limit(s) in an affirmative covenant are exceeded, technical violation occurs automatically.

In contrast, a negative covenant precludes certain actions—most frequently, the paying of dividends—if certain conditions are not met. When slack in a negative covenant falls below zero, a technical violation occurs *only* if the borrower takes the precluded action. Therefore, reduction of slack in an affirmative covenant can be more serious than for a negative covenant, since technical violation may occur automatically rather than as the result of a deliberate managerial choice (see Healy and Palepu [1989] for a related discussion).

Table 2 shows that accounting-based covenants in the sample are most often affirmative in private loans, and negative in public debt contracts. Reduction in slack may, therefore, be more serious for private debt than for public debt. Furthermore, if the observed frequencies of affirmative and negative covenants for private and public debt hold in general, prior researchers may have had an incomplete understanding of the differences between public and private debt. For example, several have hypothesized that the cost of technical violation is higher for public debt than private debt (e.g., Leftwich [1983], Collins et al. [1981], Lys [1984], and Watts and Zimmerman [1986]), because it would be more costly to renegotiate covenants for public debt. However, a complete comparison of the cost of technical violation must consider not only the cost of renegotiation, but also the nature of the constraints, which may systematically vary for debt issues having different characteristics.

Table 2 also describes the specific form of affirmative and negative covenants in the sample. The most common affirmative covenants require maintenance of particular ratios of debt to equity and current assets to current liabilities, and particular levels of working capital. The most common negative covenant restricts the payment of dividends, usually according to an "inventory of payable funds" criterion.[7] These findings are consistent with Zinbarg [1975], Castle [1980], and with the emphasis in *Commentaries* on working capital, assets/liabilities, and dividend restrictions.

The SEC's ruling on capitalized exploration costs does not affect slack in

[7] See American Bar Foundation [1971, pp. 401–421], Smith and Warner [1979], and Watts and Zimmerman [1986, p. 211] for descriptions of the typical "inventory of payable funds" computation. Generally, this inventory depends on cumulative net income (or occasionally working capital) earned after the debt issue plus stock sales, net of dividend payments and stock repurchases made after the issue.

TABLE 2

USE OF ACCOUNTING-BASED AFFIRMATIVE AND NEGATIVE COVENANTS[a] FOR 18 OIL AND GAS FIRMS (1986)

	Number of Covenants		
	Private Debt	*Public Debt*	*Total*
Affirmative Covenants			
Potentially Affected by Writedown			
Maintenance of Consolidated Net Worth	3	1	4
Maintenance of Liabilities to Shareholders' Equity Ratio	6	0	6
	9	1	10
Not Potentially Affected by Writedown			
Maintenance of Consolidated Net Worth[b]	1	0	1
Maintenance of Working Capital	4	0	4
Maintenance of Net Cash Flow	2	0	2
Maintenance of Current Ratio	5	0	5
Maintenance of Interest Coverage[c]	1	0	1
Maintenance of Assets to Liabilities Ratio[d]	1	1	2
	14	1	15
Negative Covenants			
Potentially Affected by Writedown			
Restrictions on Dividends (based on cumulative net income)	2	6	8
	2	6	8
Not Potentially Affected by Writedown			
Restrictions on Dividends (based on working capital)	1	0	1
Restrictions on Loans and Advances (based on a non-GAAP definition of net income)	1	0	1
Restrictions on Superior Indebtedness (based on a non-GAAP estimate of future net income)	0	1	1
	2	1	3
Total Affirmative and Negative Covenants	27	9	36

[a] An affirmative covenant is one that specifies limits (floors or ceilings) on accounting-based ratios, levels, or flows. Negative covenants preclude or limit certain actions unless certain conditions are met.

[b] In this modified GAAP covenant, the net worth constraint is defined such that slack is unaffected by net income earned after 1984.

[c] This covenant uses a definition of net income based on modified GAAP, in which non-cash expenses are added back to net income computed according to GAAP. As a result, the covenant is not potentially affected by the full cost ceiling writedown.

[d] Both covenants state that the ratio of net tangible assets to debt must exceed a specified ratio. Net tangible assets are as per GAAP after deducting intangibles, oil and gas properties at book value, and certain other assets.

covenants based on working capital, cash flow, and the current ratio. The slack in certain other covenants based on modified GAAP or non-GAAP definitions of net income or assets is also unaffected. Nevertheless, it is still true

TABLE 3

MAGNITUDE OF WRITEDOWN FOR THE FINAL SAMPLE OF 18 FULL COST OIL AND GAS FIRMS[a]

	Writedown 3/31/86 Form 10-Q			*Writedown 1986 Form 10-K*		
	Dollars (Millions)	*Percent of Net Worth*	*Percent of Total Assets*	*Dollars (Millions)*	*Percent of Net Worth*	*Percent of Total Assets*
Apache Corp.	0.00[b]	0	0	29.50	13	4
Chaparral Resources, Inc.	1.15	11	11	10.26	135	78
Chapman Energy, Inc.	17.02	100	22	27.00	NA[c]	43
Convest Energy Corp.	0.00	0	0	2.19	35	17
Damson Oil Corp.	68.50	116	24	69.40	157	28
Ensource, Inc.	14.50	32	9	28.30	73	20
Federated Natural Resources Corp.	3.60	36	9	6.05	72	16
Galaxy Oil Co.	0.00	0	0	4.00	86	27
Houston Oil Fields Co.	0.00	0	0	10.59	104	23
MCO Holdings, Inc.	8.00	9	1	23.00	31	4
Patrick Petroleum Co.	8.10	21	14	8.1	24	16
Pogo Producing Co.	91.30	69	13	95.75	89	14
Reading & Bates Corp.	0.00	0	0	33.10	17	4
Transco Energy Co.	247.27	26	16	284.69	32	19
Universal Resources Corp.	63.50	70	32	89.75	117	45
Wainoco Oil Co.	11.00	65	7	22.00	165	15
Wichita Industries, Inc.	5.55	132	26	5.68	169	69
Wilshire Oil Co. of Texas	8.50	55	14	15.40	83	23
Mean	30.44	41	11	42.49	82	26
Median	8.05	29	10	22.50	83	20

Note: For Universal Resources Corp., which has an October 31 fiscal year end, quarterly data are reported for the fiscal quarter ending April 30, 1986. For Chapparal Resources, Inc., which has a November 30 fiscal year end, quarterly data are reported for the fiscal quarter ending May 31, 1986.

[a] Percentages are based on net worth and total assets which would have existed in the *absence* of a writedown.

[b] Five firms in the final sample did not report full cost ceiling writedowns for the first quarter. However, these firms did report writedowns in the second quarter, and these writedowns largely resulted from the SEC's May 6 decision.

[c] Not applicable—net worth is negative.

that the slack in 18 (ten affirmative and eight negative) of the 36 accounting-based covenants (involving 13 of the 18 firms) in the sample is potentially affected by the SEC decision. For private loans, Table 2 shows that 11 covenants (nine affirmative and two negative) use accounting variables that might be affected; for public loans, seven covenants (one affirmative and six negative (all dividend restrictions)) may similarly be affected by the writedown. Therefore, even though many covenants use accounting variables which are not affected by the full cost ceiling writedown, the SEC decision *did* potentially affect most of the firms in the sample.

III. ECONOMIC CONSEQUENCES OF THE SEC DECISION

Financial Statement Impact

The financial statement impact of the ceiling writedown was often large. Table 3 shows that the writedowns ranged up to 132 percent of net worth and 32 percent of total assets in the first quarter of 1986, and up to even larger amounts for fiscal 1986.[8] The median writedown was 29 percent (83 percent) of net worth, and ten percent (20 percent) of total assets for the first quarter (fiscal year). The writedown as a fraction of net income before the writedown is not presented since 15 of the 18 firms would have reported annual losses even without a writedown. For the remaining firms, however, the median writedown was 582 percent (353 percent) of net income for the first quarter (fiscal year).

Because the writedowns reported in Table 3 are large, the SEC decision clearly could have materially affected loan covenant slack, or even have caused technical violation. If economic consequences cannot be detected in a case as clearcut as this, it is questionable that mandated accounting procedures with weaker financial statement effects can have such consequences through debt covenant slack.

Debt Covenants Impact

Tables 4, 5, and 6 describe the impact of the ceiling writedown on slack in accounting-based covenants of the 24 sample loan agreements. For each accounting-based covenant potentially affected by the writedown, we calculated the actual amount of slack remaining after the writedown and the amount of slack that would have existed without the writedown.[9] Tax effects were included if applicable. The percentage change in slack caused by the writedown was then computed as ([slack before writedown] − [slack after writedown])/(slack before writedown).

Table 4 presents results for the fiscal quarter ending March 31, 1986 and Table 5 provides similar data for the entire 1986 fiscal year. Discussion focuses on the Table 4 results, since these are probably the best estimates of the impacts expected when the SEC decision was made. However, oil prices continued to fall in the second quarter and the impact of the SEC decision continued to grow during the entire fiscal year. The overall impact of the SEC decision on loan covenant slack shown in Table 5 is similar to that in Table 4, but is larger, and affects one more firm. Table 6 presents an overall summary for each loan agreement.

Impact on slack in private loan agreements. Table 4 shows that slack in four of the 15 private loan agreements (Federated Natural Resources Corp., Patrick Petroleum Co., Universal Resources Corp., and Wichita Industries) was reduced in at least one covenant. For two of these firms, slack was completely eliminated and technical violations resulted.

Impact on slack in public loan agreements. Loan covenant slack was also affected in three of the nine public loan agreements. The writedown reduced dividend slack in two cases (MCO Holdings, Inc., and Wainoco Oil Co.), and

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[8] Annual figures are included because writedowns during the remainder of the year largely resulted from the SEC's May 6 decision. Many oil and gas firms continued to record writedowns after the first quarter of 1986, as oil prices fell to $11/bbl. by late June. Some, if not all of these writedowns directly resulted from the May 6 SEC decision. Without that decision, a firm could have at least postponed part of the writedown by simply forecasting a rise in oil prices by year's end. Furthermore, since oil prices rebounded to $16/bbl. by the end of 1986, we now know that such a forecast would have been partially realized; therefore at least part of the writedown would have been postponed permanently.

[9] The amount of slack existing for a particular covenant was measured in terms of the actual units used in that covenant. For example, slack in a dividend constraint was estimated as the amount available for payment of cash dividends under the terms of the covenant. If the ceiling writedown reduced the amount available for dividends, slack was also reduced by this dollar amount. When constraints were expressed in terms of ratios, as in a debt to equity constraint, slack was measured in terms of that ratio.

TABLE 4
IMPACT OF SEC DECISION ON SLACK IN DEBT COVENANTS FOR THE FISCAL QUARTER ENDING MARCH 31, 1986

	Affirmative Covenants[a]		*Negative Covenants*[a]
	Net Worth	*Liabilities/ Shareholders' Equity*	*Dividends*
Private Loan Agreements			
Affected by Writedown:			
Federated Natural Resources Corp.	−15%	—	—
Patrick Petroleum Co.	NA	−6%	—
Universal Resources Corp.	—	−100% (W)	—
Wichita Industries	−100% (W)	−100% (W)	−100% (W)
Not Affected by Writedown:			
Chaparral Resources, Inc.	—	—	—
Chapman Energy, Inc.	—	NM	—
Ensource, Inc.	—	—	NM
Pogo Producing Co.	—	—	NA
Wilshire Oil Co. of Texas	NM	NM	—
Convest Energy Corp.		No First Quarter Writedown	
Houston Oil Fields Co.		"	
Damson Oil Corp.		No Accounting-Based Covenants	
MCO Holdings, Inc.		"	
Transco Exploration Partners Ltd.		"	
Wainoco Oil Corp.		"	
Public Loan Agreements			
Affected by Writedown:			
Damson Oil Corp.	—	—	−100%
MCO Holdings, Inc.	−13%	—	−15%
Wainoco Oil Co.	—	—	−33%
Not Affected by Writedown:			
Chapman Energy, Inc.	—	—	NM
Galaxy Oil Co.	—	—	NM
Universal Resources Corp.	—	—	NM
Apache Corp.		No Accounting-Based Covenants	
Pogo Producing Co.		"	
Reading and Bates Corp.		"	

[a] Certain accounting-based covenants appearing in the sample were not affected by the ceiling writedown. They are: current assets/liabilities, working capital, cash flow, current ratio, interest coverage, superior debt, and limitations on loans. The latter two are negative covenants; the others are affirmative.

——No such accounting-based covenant exists in the agreement.

NA—Magnitude of slack was not affected by ceiling writedown.

W—Writedown resulted in technical violation, but creditor subsequently waived the affected covenant.

NM—Technical violation (or zero slack for dividends) existed, even without the effect of the full cost ceiling writedown.

completely eliminated dividend slack in the other (Damson Oil Corp.). The public loan agreement for MCO Holdings, Inc., had a second covenant based on net worth that was also affected by the writedown.

These added restrictions on payment of cash dividends should not have affected dividend policy for MCO Holdings, Wainoco Oil, or Damson Oil. All three companies were following policies of retaining funds for expansion, reduc-

TABLE 5

IMPACT OF SEC DECISION ON SLACK IN DEBT COVENANTS FOR FISCAL YEAR 1986

	Affirmative Covenants[a]		*Negative Covenants*[a]
	Net Worth	*Liabilities/ Shareholders' Equity*	*Dividends*
Private Loan Agreements			
Affected by Writedown:			
Federated Natural Resources Corp.	−23%	—	—
Patrick Petroleum Co.	NA	−8%	—
Universal Resources Corp.	—	?	—
Wichita Industries	−100% (W)	−100% (W)	−100% (W)
Wilshire Oil Co. of Texas	NM	−100%	—
Not Affected by Writedown:			
Chaparral Resources, Inc.	—	—	—
Chapman Energy, Inc.	—	NM	—
Ensource, Inc.	—	—	NM
Pogo Producing Co.	—	—	NA
Convest Energy Corp.	—	—	—
Houston Oil Fields Co.	—	NM	—
Damson Oil Corp.		No Accounting-Based Covenants	
MCO Holdings, Inc.		"	
Transco Exploration Partners Ltd.		"	
Wainoco Oil Corp.		"	
Public Loan Agreements			
Affected by Writedown:			
Damson Oil Corp.	—	—	−100%
MCO Holdings, Inc.	−80%	—	−61%
Wainoco Oil Co.	—	—	−100%
Not Affected by Writedown:			
Chapman Energy, Inc.	—	—	NM
Galaxy Oil Co.	—	—	NM
Universal Resources Corp.	—	—	NM
Apache Corp.		No Accounting-Based Covenants	
Pogo Producing Co.		"	
Reading and Bates Corp.		"	

[a] Certain accounting-based covenants appearing in the sample were not affected by the ceiling writedown. They are: current assets/liabilities, working capital, cash flow, current ratio, interest coverage, superior debt, and limitations on loans. The latter two are negative covenants; the others affirmative.

— —No such accounting-based covenant exists in the agreement.

NA—Magnitude of slack was not affected by ceiling writedown.

W—Writedown resulted in technical violation, but creditor subsequently waived the affected covenant.

NM—Technical violation (or zero slack for dividends) existed, even without the effect of the full cost ceiling writedown.

?—Percentage change in slack could not be calculated because Form 10-K did not disclose necessary data. However, Form 10-K did *not* indicate the presence of any technical violations.

tion of long-term debt, and other uses. None of them had paid cash dividends to common stockholders since 1982, even though dividend restrictions were generally not binding during that time. Each company stated in its 1985 through 1987 Form 10-Ks that a policy of *not* paying dividends was in effect.[10]

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[10] If these firms had been paying cash dividends, results concerning their dividend policies may have been different. For example, Healy and Palepu [1989] observe dividend reductions and omissions for firms that are close to violating their dividend constraints.

TABLE 6

SUMMARY OF IMPACT OF THE MAY 6, 1986 SEC DECISION ON SLACK IN DEBT COVENANTS[a]

Private Loan Agreements	
Affected by Writedown:	
Federated Natural Resources Corp.	Slack Reduced in One Covenant
Patrick Petroleum Co.	"
Wilshire Oil Co. of Texas	Slack Eliminated in One Covenant
Universal Resources Corp.	Technical Violation, Waived by Lender
Wichita Industries	"
Not Affected by Writedown:	
Chaparral Resources, Inc.	No Impact
Chapman Energy, Inc.	"
Convest Energy Corp.	"
Ensource Inc.	"
Houston Oil Fields Co.	"
Pogo Producing Co.	"
Damson Oil Corp.	No Accounting-Based Covenants
MCO Holdings, Inc.	"
Transco Exploration Partners Ltd.	"
Wainoco Oil Corp.	"
Public Loan Agreements	
Affected by Writedown:	
MCO Holdings, Inc.	Slack Reduced in One Covenant
Damson Oil Corp.	Slack Eliminated in One Covenant
Wainoco Oil Co.	"
Not Affected by Writedown:	
Chapman Energy, Inc.	No Impact
Galaxy Oil Corp.	"
Universal Resources Corp.	"
Apache Corp.	No Accounting-Based Covenants
Pogo Producing Co.	"
Reading and Bates Corp.	"

[a] This table shows the impact from the greater of either the first quarter of 1986 or fiscal 1986.

In summary, the 1986 first quarter ceiling writedown reduced slack or caused technical violation in seven of the 24 private and public debt contracts studied, affecting seven (39 percent) of the 18 sample firms. For three firms, slack in at least one covenant was completely eliminated. One of them, Damson Oil Corp., had slack eliminated in a dividend restriction covenant of a public debt contract. However, since Damson had not been paying dividends, the elimination of slack did not lead to a technical violation and apparently did not change management policy. For the other two firms, Wichita Industries, Inc. and Universal Resources Corp., the writedown caused actual technical violations of affirmative covenants in private loan agreements.

We conclude that the SEC decision and the ensuing writedowns did have a material financial statement impact for many full cost firms. Almost one-half of them experienced a reduction in debt covenant slack. However, technical violations occurred in the loan agreements of only two sample firms as a direct result of a writedown.

Economic Consequences of Technical Violation

Several conditions must be met for a mandated accounting change to cause a technical violation and additional conditions must be met before the technical violation leads to an event of default and action by the creditor. Therefore, the sample is divided into four categories reflecting these conditions:

I. Firms whose loan agreements contain accounting-based covenants (15 firms);
II. Category I firms that are potentially affected by the accounting procedure at issue (13 firms);
III. Category II firms that are so affected that slack is completely eliminated (three firms); and
IV. Category III firms that experience a technical violation (slack falls below zero with respect to an affirmative covenant (two firms), or a prohibited action is taken with respect to a negative covenant (no firms)).

The creditor might not act, even against firms in category IV. For public debt, an event of default generally occurs only if a technical violation continues unremedied for 30 days after the trustee gives written notice of the violation to the borrowing company (see American Bar Foundation [1971, Article 5] for details). Should the trustee elect to not deliver the notice, an event of default will not occur. The trustee can withhold notice of default from registered holders of debt if the trustee decides that so doing is in their best interests [American Bar Foundation, 1971, pp. 252, 253]; and even if such a notice *is* delivered, the debt holders can vote to waive the default provisions.

When a technical violation occurs for private debt, default generally follows automatically only if the violation continues without remedy for a specified period (usually 30 days). If an event of default occurs, the lender may agree to waive the default or to amend the loan agreement. For private loan agreements, Smith and Warner [1979] state that at least one large lender waives 95 percent of the debtor-initiated requests for loan amendments because they involve no increased risk for the creditor. Fogelson [1978, p. 777] says that:

> Where changes in accounting principles cause disruption in loan agreement covenants, institutional lenders have in the past waived defaults and modified the affected covenants to accommodate the new principles. Amendments and waivers of institutional debt agreements are relatively easy to accomplish, since the borrower need only communicate with the lender, or the lead lender of a group of institutional lenders, and negotiate the amendment or waiver.

Our data are consistent with these claims. First, the lenders provided waivers in both cases where the ceiling writedown resulted in technical violation.[11] Second, we found evidence of periodic revisions of private loan agreements. For these 15 agreements, exhibits to the Form 10-Ks indicate that amendments were made, on average, every 18 months. This estimate is conservative, since not all amendments need be included as exhibits in the form 10-Ks.

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[11] Wichita Industries reported in both a May, 1986 news release and in a *Wall Street Journal* article [April 2, 1986, p. 13] that the first quarter writedown of oil reserves would result in technical default. In the Form 10-K for fiscal 1986, the company said that the lender had waived acceleration of the due date of the obligation through December 31, 1987. The other firm (Universal Resources Corp.) reported in its April 30, 1986 Second Quarter Report that asset writedowns (90 percent of which consisted of the ceiling writedown) had led to default under certain covenants of its bank loan agreement; however, it also reported that it had received the necessary waivers from its lender.

Although technical violations in private loan agreements may be waived in most cases, exceptions might arise where (1) the debtor faces financial distress, and (2) the creditor could justifiably claim that the violation reflects a substantive economic deterioration in the debtor's financial position. In such cases, the creditor might want to take steps to reduce its exposure. These circumstances might characterize the oil and gas industry in 1986, during which 15 of the 18 sample firms reported losses. However, none of these firms reported such actions by creditors in response to covenant violations.[12]

In summary, although the SEC ruling had a large financial statement impact for several firms, it seems to have had minimal economic consequences through its impact on slack in loan covenants. Two firms did disclose that the writedown had led to technical default, but the lenders took no immediate action. This suggests that the economic consequences of other mandated accounting procedures may also be difficult to detect, at least so far as they affect debt covenant slack.

Stock Price Effects for Firms Partitioned by Impacts on Covenants

The stock price behavior of firms whose loan agreements were potentially most affected by the decision is consistent with the conclusion that the economic consequences of the May 6, 1986 SEC decision were minimal, at least as they operate through loan agreements.

Figure 2a presents a plot of abnormal returns for the portfolio of 18 full cost firms for which debt contracts were obtained. Also plotted are returns for the 13 (Category II) firms with accounting-based covenants potentially affected by the writedown, the three (Category III) firms whose slack on at least one covenant (affirmative or negative) was completely eliminated by the writedown, and the two (Category IV) firms placed in technical default solely as a result of the writedown. Figure 2b presents plots of cumulative abnormal returns for the same four portfolios.

On May 6, 1986, the abnormal returns were actually *highest* (9.0 percent) for the portfolio of two Category IV firms placed in technical default. The corresponding abnormal return was 6.6 percent for the three-firm Category III portfolio, and 1.6 percent for the 13-firm Category II portfolio. During the next two days, the Category III and Category IV portfolios continued to have higher abnormal returns than the other full-cost portfolios.

Since it is hard to imagine that the SEC decision had a positive impact on the affected firms, the results in Figures 2a and 2b suggest that a confounding effect is present. The most likely explanation is the tax legislation discussed in Section I.[13] In any case, there is clearly no evidence in either Figure 2a or Figure 2b that the SEC decision had *negative* economic consequences, even for those firms which potentially were the most

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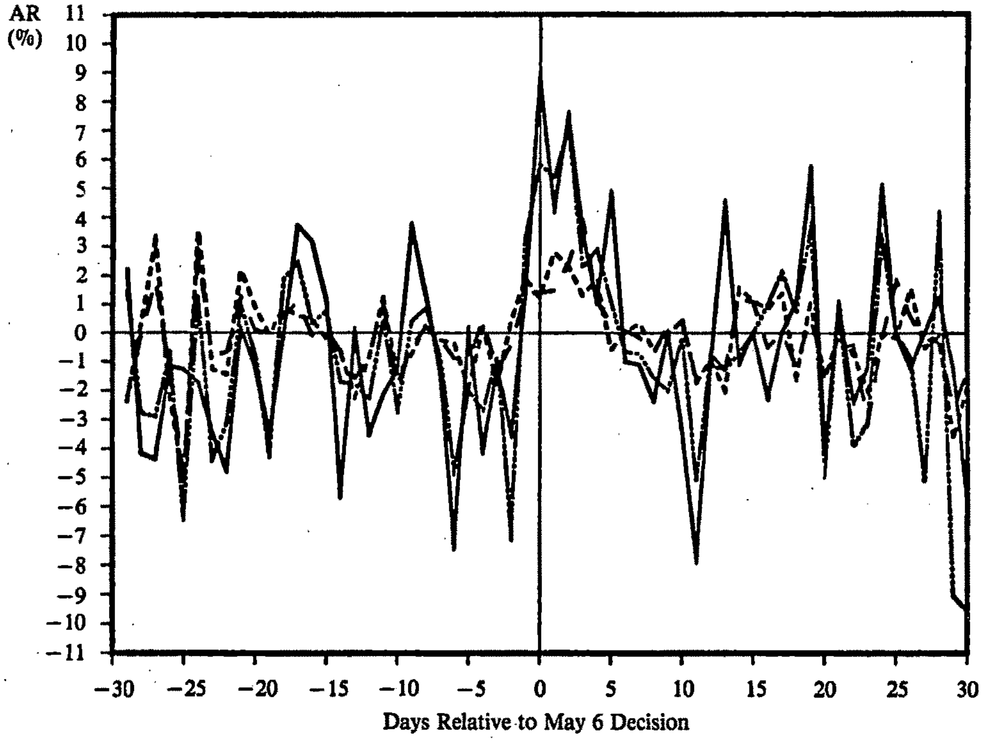
[12] Private loan agreements for ten of our 18 sample firms specify that the lender may adjust the borrowing base if the estimated present value of oil and gas reserves changes. Since the drop in petroleum prices during 1986 reduced the present value of these reserves, it is possible that lenders protected their position through borrowing base adjustments. Such adjustment would reduce the dependence of lenders on accounting-based covenants in the loan agreements. However, our review of Form 10-Ks and 10-Qs found no sign of defaults caused by borrowing base reductions.

[13] As discussed in Section I, security price effects of the legislation are expected on days +1 and −1 relative to the May 6, 1986, SEC decision. However, it is possible that security prices on surrounding days, including May 6, were also affected.

FIGURE 2A
ABNORMAL RETURNS FOR FULL COST PORTFOLIOS
RELATIVE TO MAY 6, 1986



Legend: — Entire Sample ($n=18$)
— Potentially Affected (Category II; $n=13$)
— Slack Eliminated (Category III; $n=3$)
— Technical Violation (Category IV; $n=2$)

affected. If such negative consequences occurred, they must have been overwhelmed by other factors affecting stock returns at the same time.

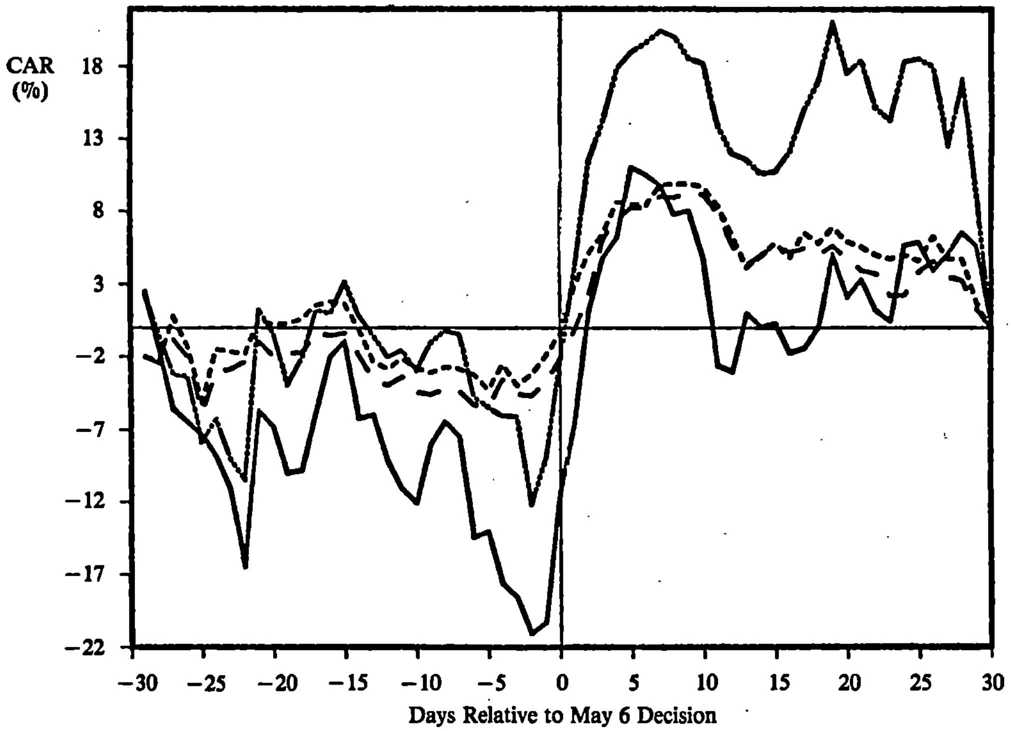
A Comment on Research on Other Mandated Accounting Procedures

A natural question concerns why there are no apparent economic consequences (via debt covenants) of the 1986 SEC decision, even though several prior researchers (e.g., Lev [1979], Collins and Dent [1979], and Lys [1984]) have documented a significant stock price reaction to the 1977 FASB decision on full cost accounting. In considering this question, it is useful to reexamine some evidence in the Lys study of the 1977 decision.

Lys [1984, p. 55] estimates that if all debt held by full cost firms in his sample were placed in default and all creditors demanded refinancing at the then current market rates, the cost (increase in the value of the debt) would be, on average, 2.5 percent of the value of common equity. This should then represent an upper bound on the cost of debt covenant violations as a result of the FASB decision. Since few full cost firms would have technical violations for any debt

FIGURE 2B

CULUMATIVE ABNORMAL RETURNS FOR FULL COST PORTFOLIOS RELATIVE TO MAY 6, 1986



Legend:
— Entire Sample ($n=18$)
— Potentially Affected (Category II; $n=13$)
— Slack Eliminated (Category III; $n=3$)
— Technical Violation (Category IV; $n=2$)

issues resulting from the decision [Foster, 1980], the actual expected cost could be far less than this upper bound and might not be detectable in a stock price study. This casts doubt on whether bond covenant effects could explain either the 1.7 percent average decline in share value for full cost firms on the event day (July 19, 1977), or the 4.2 percent decline over the three-day window around that date, as reported by Lys. In fact, the security price behavior may have been caused by confounding news events related to legislation affecting the oil and gas industry (e.g., *The Wall Street Journal* [July 22, 1977, p. 1], reported favorable prospects for passage of President Carter's energy bill, which would have had an adverse effect on oil and gas producers).

IV. CONCLUSIONS

In this study, we have assessed the economic consequences of a mandated accounting procedure on 18 firms in a single industry, by examining its impact on slack in 24 of their public and private loan agreements. To our knowledge, the sample is larger than that in any published study of actual public and private loan agreements, and provides the basis for a detailed examination of how such agreements were affected by a mandated accounting procedure.

There are several reasons why, if mandated accounting procedures can have important consequences on existing loan agreements, we should have been able to detect them in this case. First, the financial statement impacts of the SEC decision studied here were large. Second, the decision was a surprise and came when it was too late for firms to take actions to avoid any technical violation that might be caused by applying the mandated procedure. Third, creditors could justifiably claim that technical violations reflected a major economic deterioration in the debtors' financial positions.

Despite these conditions, we find no evidence of economic consequences resulting from loan covenant violations caused by the SEC decision. Even where technical violations occurred, the creditors did nothing as a result. Our findings cast further doubt on the significance of economic consequences of mandated accounting procedures that might operate through impacts on existing debt contracts.

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BOOK REVIEWS

Richard P. Brief, Editor

Editor's Note: Books for review should be sent to Professor Shane R. Moriarity, School of Accounting, University of Oklahoma, Norman, OK 73019.

WAGDY M. ABDALLAH, *International Transfer Pricing Policies* (Westport, CT: Quorum Books, 1989, pp. viii, 162, $42.95).

The area of multinational transfer pricing has become increasingly important. For example, estimated intra-firm imports into the U.S. totalled 80 billion dollars in 1986 [Finn and Healey, 1987]. Nevertheless, surprisingly little has been written and only recently has some research attention been focused on this topic.

This book gives an elementary treatment of international transfer pricing (ITP), but contrary to its claims, falls far short of being a "comprehensive guide" for multinational enterprise (MNE) executives involved with ITP decisions. However, this work might have some use for students and executives who wish to get a quick exposure to some of the main issues.

The introductory chapter identifies the reasons why firms look for markets and production opportunities abroad and lists the factors which need to be considered in ITP policy formulation. A meaningful integration of these factors with some illustrative case studies would have greatly enhanced the appeal of this chapter and the book. Furthermore, one factor which seems to have been overlooked completely is the issue of information asymmetries. Differential information on markets, technology, and local environment between headquarters and foreign subsidiaries often motivates decentralized operations and consequently, the need for transfer prices.

The second chapter presents a conceptual framework to analyze the inputs, the process, and the outputs of ITP. Here again, it would have been useful to provide specific guidelines on how to make transfer pricing decisions with some theoretical support and illustrative examples.

The third chapter identifies the objectives of transfer pricing. These are supported by empirical evidence and examples, making this chapter the most useful and readable in the book. However, in the examples, the assumptions are sometimes stated after the discussion. For example, on page 36, the assumption that no loss can be carried forward is stated after the example is worked out.

The fourth chapter deals with ITP techniques such as the use of market price, full cost, marginal cost, and shadow prices. These techniques do not differ in concept between domestic and international transfer pricing decisions though the considerations in applying any one of them may be different. This point needs greater emphasis.

The fifth chapter identifies five decisions which might be affected by the transfer pricing rule but examines only the capital budgeting decision in detail. The variables which need to be considered for this decision have been comprehensively identified. The additional complexity in the application of NPV and other capital budgeting methods for foreign investments is highlighted.

The sixth chapter examines the relation between ITP and international taxation. The section on tax systems of selected foreign countries is particularly useful. However, in discussing current U.S. position, no mention is made of several landmark cases such as Eli Lilly and DuPont. These and other developments have in fact resulted in the issuance of a white paper on Section 482 of the Internal Revenue Code jointly by the Treasury Department and the IRS.

The seventh chapter deals with the effect of environmental factors such as inflation, tariffs, foreign exchange rates, and balance of payments on ITP. The book does not examine specific relationships; the only discussion is on how each factor, in general, might potentially affect transfer prices.

Overall, the book lacks an integrated approach to the international transfer pricing problem. For example, Rugman and Eden [1985] present a framework in which the MNE managers try to mitigate the combined effects of tariffs, taxes, capital flow restrictions, and incentive problems on efficiency. Such a framework can result in specific guidelines for decision making. In contrast, the issues discussed in the book are not held together by a unifying theme.

There are also several inaccuracies. For example, the payback formula on page 71 and the modified NPV formula on page 74 are not accurate. In the example which discusses the effect of inflation on transfer prices (p. 99), there are two problems: first, the transfer price has been increased from five dollars to six dollars or 20 percent while the inflation rate is ten percent. There is no explanation on why the transfer price should increase more than the inflation rate. Second, the total firm profit is reduced because the input prices have been increased by the inflation rate, but the final product price is held constant. Transfer price merely allocates the income between the two divisions and for given input and output prices, changes in transfer price do not affect the firm's profits.

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MICHAEL GIBBINS and ALISTER K. MASON, *Professional Judgment in Financial Reporting* (Toronto, Canada: The Canadian Institute of Chartered Accountants, 1988, pp. 204).

This monograph is, in the authors' words, designed "... to explain and evaluate the role of professional judgment in financial reporting, as viewed by both preparers and auditors, with particular regard to the use of the term in accounting standards." With this objective in mind, the authors identify and critique the use of judgment and professional judgment as terms in the professional literature, review existing research literature on judgments for relevant insights, and carry out a modest questionnaire-based research design to solicit insights from practitioners. In developing their arguments, they assert that two aspects of professional judgment process are especially important. "(1) That professional judgment must operate within the confines of statutes, accounting principles, standards and ethics; and (2) That a professional judgment process is imperfect." In addition, in order to provide some framework for the exposition in the monograph, the following rather cumbersome definition for professional judgment in financial reporting is provided:

> Professional judgment in financial reporting is judgment exercised with due care, objectivity and integrity within the framework provided by accounting and other applicable standards, by experienced and knowledgeable people on accounting and financial reporting issues arising in the preparation and issuance of financial statements, annual reports, prospectuses and similar documents.

The primary result of the analysis in the monograph are 32 recommendations regarding the nature of professional judgment, its impact on and role in standard setting, and recommendations for those exercising professional judgment. These recommendations are summarized in Chapters 12, 13, and 14 at the end of the monograph. These recommendations are a rather heterogeneous collection of positions apparently aimed at standard-setters and practitioners making judgments about financial reporting matters. A few of the recommendations have educational implications, but very few of them are aimed at issues upon which academics in the American Accounting Association could develop researchable questions. While the recommendations do seem rational, their degree of support in the logic and evidence presented in the monograph varies considerably.

The research study designed to elicit beliefs on how professional judgments are applied in financial reporting from senior financial statement preparers is of interest to the academic reader. The subjects are senior financial statement preparers in either the private or public sector of Canadian accounting practice. Of particular interest were some of the general findings from the auditors and industry accounting persons in the private sector. Their responses indicate support for a common framework in professional judgment. This common framework is characterized by the following steps: (1) referring to standards; (2) consulting with others; (3) considering the client or company's needs; (4) considering the readers/users of the financial statements; and (5) considering precedents/prior experiences. Also, there was a high degree of consistency in beliefs that justification of recommendations was important and that the judgment process was essentially a group decision-making activity. These subjects also indicated that it was very common to try to identify the consequences of recommendations that they made.

In addition to the research study, academic readers (particularly those not currently involved in judgment and decision-making research) will find Appendix B, the authors' analysis of prior judgment research, to be illuminating. This may be the best part of the monograph and is a good nontechnical summary of judgment research and some of its applications in accounting and auditing.

In summary, this monograph takes on an ambitious topic. For the practicing professional who is in fact preparing or evaluating financial reports it is quite useful reading. For the academic reader there is considerable material in the early chapters that is not particularly interesting. However, the reported research study and the summary of judgment in decision-making research in Appendix B do make the monograph worth considering. The general nature of the analysis and recommendations will not support direct use by the academic interested in designing research on the use of "professional judgment."

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T. A. Lee, Editor, *The Evolution of Audit Thought and Practice* (New York and London: Garland Publishing, Inc., 1988, pp. xxvii, 316, $40.00).

This compilation was commissioned by the Scottish Committee on Accounting History of the Institute of Chartered Accountants of Scotland so that its content comes from both sides of the Atlantic. There are 22 pieces reprinted in this volume with only a slight majority claiming North American origins. As a result, it is quite likely that most readers will find some unfamiliar pieces as well as some expected standards. There may be some surprises among those selected as well as a few unexpected omissions. Most of the expected authors are represented though not for more than one piece and that may not be the one anticipated. The content includes excerpts from books as well as journal articles and emphasizes primarily developments in the nineteenth and twentieth centuries.

The editor claims a role for this book in a relatively barren literature devoted to the topic. To support this claim, some general accounting history efforts are cited that have included references to auditing and a few other pieces on specific topics are mentioned as well. Beyond that, little else on auditing's development is acknowledged except for scattered individual articles, or sections of books, several of which are reproduced here.

The stated aim of this book is "a historical study of auditing rather than a study of the history of auditing," choosing to focus on "changing audit aims and practices revealing the importance of auditing in society generally and business activity particularly." Both the character of the auditor and the development of the profession also receive attention as part of this survey.

The content of the volume is organized under six topic areas. In addition to an introductory series of three pieces captioned "Changes in Thought and Practice," the editor has followed with a section on "Developments in the U.K. Context" and another on "Developments in the U.S. Context." Each of these surveys contains three pieces as well.

There follows a series of four pieces captioned "Developments and Continuing Concern." The volume then concludes with a section entitled "Evidence of Early Audit Thought and Practice" and one labeled "Evidence of Contemporary Audit Thought and Practice."

As might be expected, R. Gene Brown's classic on "Changing Audit Objectives and Techniques" from the October, 1962, The Accounting Review is the lead article. There follows "Auditing in Perspective" from *The Philosophy of Auditing*. Concluding the first section is a piece from Littleton and Zimmerman's *Accounting Theory: Continuity and Change.*

The "Developments in the U.K. Context" focus primarily on different perspectives of the British Companies Acts with articles by Leonard Hein, J. R. Edwards and K. M. Webb, and J. Kitchen. The papers included in the "Developments in the U.S. Context" are a little more varied with one on auditing railroads by James Boockholdt, Moyer's "Early Developments in American Auditing," and Bruce Committe's piece on the development of the profession in the United States, from the Working Paper Series of the Academy of Accounting Historians.

The selection of developments and concerns for inclusion may provide a mild surprise both as to topics and as to authors. The four topics are "true and fair" discussed in a paper by J. G. Chastney, Richard Brief's enlightening article on the historical perspective of the accountant's responsibility (particularly with regard to uncertainty about the future), an article on third-party liability by J. J. Davies, and one on independence by Edward Younkins.

The timing of the articles in the "Evidence of Early Thought and Practice" section range from 1891 (Arthur Drummond) to 1912 (R. H. Montgomery). Walter Staub's 1904 "Mode of Conducting an Audit" is there together with an 1897 piece by W. Robertson on auditor's responsibility and one by M. Webster Jenkinson on auditing in Scotland in 1913–1914.

Among the contemporary audit thought and practice pieces are the Herman Bevis article that established the "attest function" and David Flint's exploratory essay on "The Role of the Auditor in Modern Society." John C. Burton and Patricia Fairfield's recent article on "Auditing Evolution in a Changing Environment" concludes the book. The editor also includes a piece of his own on "The Modern Audit Function" as well as an extended introduction justifying the items selected for inclusion.

In a little over 300 pages there is not much room to address the substantial changes that have affected the auditing profession over the past 150 years in Great Britain and the United States. The editor has had to do some careful selection and chose to stay mostly at the survey level with an occasional vignette to provide an example. While it may be true that the literature dealing with the history of auditing may not be as large as might be desired, there are still several issues only hinted at at most. The bibliographies at the end of the articles may prove to be as valuable as some of the articles in this respect.

Nevertheless, the editor has made a valuable attempt to capture a sense of history in the recent development of the process and the profession called auditing that has not been previously accomplished. May his effort serve as a challenge to bring more extensive contributions to the field.

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GEORGE J. MURPHY, *The Evolution of Selected Annual Corporate Financial Practices in Canada 1900–1970* (New York and London: Garland Publishing, Inc., 1988, pp. ix, 221, $35.00).

George Murphy is one of the few accounting historians writing about Canada and the book under review is to be welcomed as a readily available means of dispelling the ignorance of most non-Canadians on the development of corporate financial reporting in that country.

The great facts of Canadian history are its mixed British and French origins and its proximity to the United States. The French play no role whatsoever in this book but relevant British and American developments are covered throughout. Murphy's hypothesis is that "the evolution of Canadian reporting practices has been, over the years, an interesting interplay of English [*sic*] and American influence acting upon, and together with, the unique elements of the Canadian scene" (p. 3). He pays no attention to developments in other English-speaking countries such as Australia and New Zealand.

The core of the book is three chapters which describe the evolution of financial statements in Canada from 1900 to 1970 by reference to corporate legislation, financial press commentary, the professional and academic literature, and a sample of corporate annual financial statements. These are preceded and followed by a chapter each on auditing and depreciation. The former is rather heavy going and might have been better placed later in the book.

Murphy sees the 1930s as the decade in which the dominant external influence on Canadian financial reporting became American rather than British (p. 27). This happened, he argues, because of geographic proximity (but that was always there), the increasing U.S. investment, and the articulateness of the American Institute of Accountants. But the transition took time. For example, in 1951 the Canadian Institute of Chartered Accountants was still supporting the phrase "true and correct" in audit reports. The British had substituted "true and fair" in 1948. It was not until 1959 the the CICA recommended the U.S. phraseology of fair presentation in accordance with generally accepted accounting principles.

Murphy stresses throughout the importance of Ontario legislation on federal legislation and the influence on the former of the Ontario Institute of Chartered Accountants and of British legislation—but as early as 1907 the legislation of Ontario had developed beyond its British counterpart. (Something rather similar had happened about a decade earlier in the Australian state of Victoria.) Canadian law and practice was in advance of British in the area of consolidated statements.

"Anglo-Saxon" accounting is often distinguished from that of Continental Europe and Latin America by the unimportance of tax rules. But such a distinction is not absolute: tax rules always have some influence. In Canada, according to Murphy, the influence of the tax department on depreciation practice has been both profound and pervasive:

> Between 1932 and 1954, tax requirements forced a certain correspondence between book and tax depreciation, which meant that between those years most companies used the straight line method of depreciation and between 1949 and 1954 most companies began to use the tax department version of the diminishing balance method. The rescinding of the correspondence requirement in 1954 again led many companies to change their depreciation methods (p. 154).

In the area of inventory valuation, LIFO is rare in Canada for the same reason as in Britain: its inadmissibility for tax purposes, which resulted from a Canadian case taken on appeal in 1956 to the Privy Council in London.

Events in Canada often paralleled those in other English-speaking countries. The CICA's first Recommendation in 1946 postdates those of the American and English Institutes (1939 and 1942, respectively) but appeared in the same year as that of the Australian Institute. *Financial Reporting in Canada* (1953 onwards) began later than *Accounting Trends and Techniques* but much earlier than its British equivalent (1970). Australia, for some reason, has produced only sporadic surveys of corporate financial reporting practice.

This book closes with 1970 so there is no discussion of the CICA's unique role in standard setting. Elsewhere (*Accounting Historians Journal*, Spring 1986), Murphy has attributed this in part to Canada's relative lack of corporate scandals which have rebounded to any enduring discredit of the accountancy profession. Here he notes how much of the Canadian concern has been vicarious, the financial and professional literature dwelling at enormous length on the Britsh Royal Mail Steam Packet case and the American McKesson & Robbins case (p. 157). In the 1980s Canada has had a few scandals of its own to worry about.

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Christopher W. Nobes and Robert H. Parker, *Issues in Multinational Accounting* (Oxford: Philip Allan Publishers Limited, and New York: St. Martin's Press, Inc., 1988, pp. xi, 183, $49.95).

This book contains eight chapters, loosely linked by some relation to the multinational enterprise (MNE). Nobes and Parker, two well-known international accounting professors in the United Kingdom (U.K.), have edited the book, and, in addition, have individually written three of the chapters and collaborated on a fourth. Two chapters were written by two other U.K. accounting academics (S. Gray and C. Roberts) and the contributors of the remaining two chapters are researchers in economics, finance, and international business, all in the U.K. (J. Dunning, S. McLeay, and R. Pearce) except for J. Arpan, Director of International Business Programs at the University of South Carolina.

The text is divided into three parts. Part I consists of one chapter, by Dunning and Pearce, which highlights the increasing importance of MNEs. The chapter provides data showing changing patterns and recent growth in direct foreign investments as well as the importance to leading industrial firms of overseas production, sourcing, and sales. Then, a simple theory of international production is described. Finally, the issues in evaluating the desirability of the increasing MNE influence, particularly from the host country's perspective, are summarized. These issues include economic efficiency, equitable distribution of gains (or losses) between the MNE and the host country, and host country sovereignty and the development of economic self-reliance, particularly in the long run.

Part II consists of three chapters, two authored by Nobes and one by Parker, which are devoted to comparative financial reporting. These chapters are the most closely integrated portion of the book. They form a cohesive discussion of the causes of differences in international financial reporting, the differing treatment in major areas, and a conceptual framework for viewing the regulation of accounting practices.

In one chapter, Nobes identifies seven factors which he believes underlie differences in financial reporting. These are (1) differences in legal systems, (2) the different sources of capital, (3) the influence of the tax system on accounting, (4) the size and importance of the accountancy profession, (5) the degree of inflation, (6) the influence of microeconomic theory, particularly with respect to the relevance of replacement cost data, and (7) the effect of nonsystematic, exogenous economic and political events. Most of these factors are not new. Both Gerhard Mueller, in several articles as well as his well-known texts in international accounting, and Nobes himself, in his earlier writing, have identified and discussed the most important of these factors.

Another chapter in this part, also by Nobes, provides a brief discussion of eight areas where major differences occur. These are (1) the relative emphasis given to fairness rather than formal conformity to rules, (2) the impact of taxation on depreciation, bad debt provisions, and asset valuations, (3) the influence of conservatism versus accrual theory, (4) the distinction between provisions as charges *against* profit and appropriations *of* profit, (5) alternative valuation bases, (6) the extent and importance of consolidated statements, (7) the degree of uniformity of application of accounting principles and of statement format and disclosure, and (8) the extent of financial statement orientation to enterprise shareholders.

In the final chapter of Part II, Parker concentrates on how unique economic, political, cultural, and historical factors in countries with an Anglo-Saxon heritage (the U.S.A., the U.K., Australia, and Canada) have resulted in different approaches to regulation, in spite of the prevalence of quite similar reporting practices. For his discussion, Parker adopts the Puxty, Willmott, Cooper, and Lowe regulatory framework, which identifies three regulating mechanisms—the market, the state, and the professional community. Parker then traces how these three factors have combined in different ways to regulate accounting in four major English-speaking countries.

Part III of this book contains four chapters devoted to a more extensive treatment of four specific problem areas of relevance to MNEs—consolidation, segment reporting, financial statement analysis, and international transfer pricing. In the chapter on consolidations, Parker and Nobes summarize the EEC Seventh Directive, and note the effect on the major EEC countries. In general, they see a movement toward an increased level of consolidation and harmonization of practice along Anglo-American lines.

In another chapter, Roberts and Gray review the practices in providing disaggregated reports in the U.S. and the U.K., along with the positions of international bodies on segmental disclosure. They summarize research results showing, in general, the benefits of utilizing segment data in models to achieve better predictions and significant associations of stock market betas with accounting numbers derived from segment disclosures. Segment disclosure costs are also discussed, including both the direct accounting system cost and possible indirect costs stemming from release of information which could be potentially misleading and/or cause competitive disadvantage.

In the chapter on financial statement analysis, McLeay illustrates how national differences in business, social, and economic practices along with terminology, disclosure, and currency translation differences can lead to noncomparability in financial reports. A statistical model is also developed and applied to a three-country (U.K., U.S., and Japan) sample of current ratio data. This model, which simultaneously provides estimates of country and sector (industry) effects, would be very useful in making international comparisons.

In the final chapter, Arpan shows how international transfer pricing can be used to achieve corporate goals. International differences in motives for formulating transfer prices are reported, based on a rather dated (1972) study.

Today, U.S. firms increasingly look to foreign markets and suppliers, foreign investment and consumption of foreign goods play a larger role in the U.S. economy, and public accounting firms search the international scene for growth opportunities. In this environment, it is inevitable that accounting instruction and research will also increase its international components. This book, more an anthology than a focused series of papers, would be of interest to teachers and researchers in a wide variety of areas who are looking for an international perspective in financial and managerial accounting, auditing, and financial statement analysis. Much of the material in this book is descriptive in character; this would be useful to those who want to make international comparisons. Even more useful, however, are the frameworks for analysis, the typologies, and the occasional analytical model, which can be used to organize and analyze data and practices in different national settings.

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MIKLOS A. VASARHELYI, Editor, *Artificial Intelligence in Accounting and Auditing: The Use of Expert Systems* (New York: Marcus Wiener Publishing, Inc., 1989, pp. xiii, 448, $49.00).

This book seeks to link the literatures of accounting, auditing, and expert systems. The collection includes an introduction plus 19 articles, ten of which have been published (denoted below by *). These papers are organized into five sections: Foundations, Methodology and Surveys, Applications in Auditing, Applications in Accounting, and Applications in Practice. Specific topical coverage focuses on tax accrual assessments, estimation of bad debt allowances, audit risk assessment, evaluation of internal controls in computer systems, and statistical sampling. The authors include 22 professors, one student, and six accounting practitioners.

The first two articles introduce key concepts of expert systems and artificial intelligence: "Artificial Intelligence, Cognitive Science, and Computational Modeling in Auditing Research: A Research Approach" (Bailey, Hackenbrack, Prabuddha, and Dillard)* and "On the Future of Knowledge-Based Accounting Systems" (McCarthy). These papers define terminology and discuss knowledge acquisition, knowledge representation, modeling, and validation.

Articles in Section II link expert systems to research in management accounting, auditing, and financial accounting standards. The papers focus on components of expert systems, survey state-of-the-art systems, and identify unanswered questions and directions for future research: "Expert Systems and Management Accounting Research" (Lin),* "Decision Support and Expert Systems in Auditing: A Review and Research Direction" (Abdolmohammadi),* "A Computational View of Financial Accounting Standards" (Gangolly), and "Expert Systems in Auditing: State of the Art" (Messier and Hansen).

Section III provides an overview of methodological issues encountered in field applications. Articles consider judgments, EDP auditing, audit scheduling, and internal control evaluations: "The Use of Rule-Based Expert Systems to Investigate the Effects of Experience on Audit Judgments" (Gal and Steinbart), "A Preliminary Investigation of EDP-XPERT" (Hansen and Messier),* "Scheduling Internal Audit Activities" (Boritz and Broca),* "Internal Control Evaluation: A Computational Model of the Review Process" (Meservy, Bailey, and Johnson),* "Knowledge-Based Expert Computer Systems in Auditing" (Dillard and Mutchler), and "Scheduling the Monitoring of EDP Controls in Online Systems" (Hansen and Messier).*

Articles in Section IV focus on three prototype system applications: "An Accounting Prototype Expert System" (O'Leary and Munakata), "An Expert System for Cash Flow Analysis" (O'Leary and Lin), and "The Role of Expert Systems in Accounting Research" (Steinbart and Gal).

Section V considers applications in practice: "Developing ExpertTax: An Expert System for Corporate Tax Accrual and Planning" (Shpilberg and Graham),* "Interim Report on the Development of an Expert System for the Auditor's Loan Loss Evaluation" (Kelly, Ribar, and Willingham),* "Expert Systems: What They Mean to the Executive" (Turban and Mock), "The Mortgage Loan Analyzer—An Expert System for Underwriting Residential Mortgage Loans" (Smith and Temple).

The articles collected in this volume do provide readers with an introductory overview of artificial intelligence in accounting and auditing. For the most part, they are free of jargon, obtuse mathematics, symbolic notation, and the minute detail required for most real applications. While many papers have common elements, the editor's selections have minimized redundancy. Readers seeking a "general overview" will be satisfied with this book: those interested in a "how to" book must look elsewhere.

RONALD COPELAND
Cowan Research Professor
Northeastern University

G. WHITTRED and I. ZIMMER, *Financial Accounting: Incentive Effects and Economic Consequences* (Sydney: Holt, Rinehart and Winston, 1988, pp. xv, 341).

This Australian book is quite unusual. It represents a departure from traditional intermediate/advanced financial accounting texts. Traditional texts usually focus on accounting theory, conceptual frameworks, authoritative pronouncements, and accounting techniques. In contrast, Whittred and Zimmer have written a text which seeks to explain financial accounting and external reporting practices through an interpretation of the empirical research literature. They view accounting as having a role to play in regulating the relations between contracting parties (in particular corporate management and investors) and in performance monitoring. Like Watts and Zimmerman's *Positive Accounting Theory*, Whittred and Zimmer's text is embedded in the agency theory/costly contracting paradigm. Because Whittred and Zimmer's text has, in the main, a fairly standard structure in terms of chapter headings, it slots in quite easily to an established intermediate/advanced teaching program. It is the contents of the chapters which make it unique, and a pleasure to use in the classroom.

The book falls into three parts. The first part, comprising Chapters 1 and 2, establishes the framework within which specific accounting issues dealt with in subsequent chapters are examined. Chapter 1 only briefly describes the standard setting institutional framework in Australia. The chapter is more concerned with why certain groups may have an interest in the outcome of the standard setting process. Incentive effects and economic consequences are discussed in this context. Chapter 2 develops the agency theory/costly contracting perspective of financial accounting. The authors argue that financial contracts entered into by the firm are likely to be an important determinant of management's preferred accounting policy. In this, and all chapters, argument is supported by extensive reference to the research literature, including a lot of Australian research that could be of value to North American academics interested in the agency theory paradigm.

The second part of this book comprises Chapters 3 to 10. These chapters deal with the major components of the balance sheet and income statement, that is, owner's equity, assets, liabilities, and net income as well as subsets of these components such as intangible assets, lease liabilities, and company income tax. Some elements of each chapter are in conventional format, such as the discussions of relevant definitional and normative issues. Also, applicable Australian accounting standards and statutory financial reporting requirements are examined in a fairly orthodox way. Illustrations using accounting procedures tend to be skeletal, but are generally sufficient to illustrate the topic at hand. (This is not a criticism because the book makes no claim to being technique exhaustive.) The real contribution of this book lies in the way the authors have skillfully interwoven the agency theory/costly contracting research literature (of which they have been significant contributors themselves) into their discussion of accounting standards development, accounting policy choice by management, market reactions to accounting standard releases, and the use made of accounting information by capital market operators.

The third section of this book, Chapters 11 and 12, examine two instances where the authors contend that managerial contracting designed to minimize agency costs has contributed to the evolution of accounting practice. These instances are accounting for intercorporate investments (consolidated financial statements and equity accounting) and accounting for unincorporated contractual joint ventures. As an example of the approach taken, the authors argue that consolidated financial statements can reduce the agency cost of debt as creditors require a comprehensive financial profile of a group of related companies when cross-guarantees (which are usual) have been put into place.

At the end of each chapter the authors pose a series of provocative discussion questions, exercises, and case studies, many of which are based on extracts from financial papers and business journals. These really bring the subject matter to life and demonstrate to students how relevant financial accounting and reporting is within the business world today. Fortunately, a comprehensive instructor's manual, with suggested solutions, is available.

Two important topics which this book does not examine are foreign currency translation and funds flow reporting. Given the wealth of research literature in these two areas, these topics would have been worthwhile inclusions. However, this is the first edition and I understand that a second edition is in preparation. It is likely that these topics will be covered in the next edition.

Many universities in Australia and New Zealand quickly adopted this book for their undergraduate program, and it is now used in some postgraduate programs as well. This is testimony to the high regard my colleagues have for the work of these two authors.

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Associate Professor in Accounting
Macquarie University

NEW BOOKS: AN ANNOTATED LISTING

Editor's Note: As a general policy, books received but not reviewed in this or future issues will be annotated. There will be some exceptions.

JANE B. ADAMS, RONALD J. BOSSIO, and PAUL ROHAN, "Accounting for Contributed Services: Survey of Preparers and Users of Financial Statements of Not-for-Profit Organizations," *Financial Accounting Standards Board: Special Report* (Norwalk, CT. Financial Accounting Standards Board, pp. vii, 54, $12.00 paper).

Study presents results from two FASB surveys conducted to obtain information on not-for-profit organizations' current methods of accounting for contributed services. First survey, directed to financial statement preparers, was mailed to 5,500 participating organizations. Second survey, directed to users of not-for-profit financial statements such as lenders, donors, regulators, and accreditation boards, was mailed to 170 users requesting information about the relevance of information about contributed services to their decision to contribute or lend resources to not-for-profit groups. Report contains profiles on respondents, survey findings, and reproduction of the surveys used.

J. BATTY, *Accounting for Research and Development*, Second Edition (Aldershot, England and Brookfield, VT: Gower Publishing Company Limited, 1988, pp. xiii, 238, $69.95).

Presents a framework for the organization and control of corporate research and development expenditures. Four broad issues are examined: organization and selection of projects; financial and accounting implications; measurement of results; and systems design. Topics discussed include the role and placement of the R&D department in the company, how R&D relates to the objectives and long-range goals of the company, and planning the R&D program. Other subjects dealt with are the principles for budgetary control of the program and its projects, appraisal of the program, policies of accounting treatment for R&D expenditure, impact of R&D on company liquidity and cash management, design of cost accounting, and other systems for R&D. The final section presents five case studies.

Joseph Batty, a former Prinipal Manager with Coopers & Lybrand, is a management consultant, author, and academic.

GERMAIN BÖER, *Use of Expert Systems in Management Accounting* (Montvale, NJ: National Association of Accountants, 1989, pp. xi, 55, $13.95).

This descriptive study focuses on the use of expert systems to evaluate budget variances in two companies. A third company that had used expert systems was studied to determine other areas in management accounting where expert systems might be used. The introductory chapter discusses the general concept of expert systems, expert systems in an accounting environment, and the expert systems at the participating companies. Chapter 2 illustrates the rule-based approach used in the expert system prototypes developed for the two participating companies. Chapter 3 provides some observations based on the author's experience in developing the prototype systems and on the experience of the company personnel who worked at developing applications in their companies. Appendix A describes some technical issues in expert systems and Appendix B deals with the software products used to create expert systems which are called expert system shells.

Germain Böer is Professor of Accounting at Vanderbilt University.

The Book-keeper and *The American Counting Room*, Foundations of Accounting Series (New York and London: Garland Publishing, Inc., 1988, pp. 1992, $260.00).

Reprint edition of the first accounting journal published in America. *The Book-keeper* was published in New York from July 20, 1880 to June 19, 1883, when its name was changed to *The*

American Counting Room, published from July, 1883 to June, 1884. Selden R. Hopkins was the first editor and Charles E. Sprague became co-editor soon after publication.

ALAN GART, *An Analysis of the New Financial Institutions* (New York; Westport, CT; and London: Quorum Books, 1989, pp. xx, 376, $59.95).

Sixteen chapters detail the changing technologies, financial structures, distribution systems, and deregulation of financial institutions. Book begins with an introduction to commercial banking and then discusses the asset composition of commercial banks, the capital and liability accounts, and asset and liability management. Text then goes on to discuss international banking, savings and loans, savings banks, credit unions, investment companies, pension plans, finance companies, property and casualty insurance companies, investment banking, and the securities industry. The concluding sections contain a 12-page glossary and list of suggested readings on the topics discussed.

Alan Gart is Professor of Finance at Lehman College of the City of New York and Visiting Professor at Columbia University.

HAROLD Q. LANGENDERFER and GROVER L. PORTER, Editors, *Rational Accounting Concepts: The Writings of Willard J. Graham*, Foundations of Accounting Series (New York and London: Garland Publishing, Inc., 1988, pp. xvi, 508, $40.00).

Willard J. Graham was an early contributor to accounting and business journals and a leader in management education. This book contains reprints of Graham's writings and is divided into four parts: budgeting for manufacturing firms and use of accounting for rate setting purposes; using cost information in making decisions; financial reporting issues, including price level accounting, leases, depreciation, and deferred income taxes; and accounting and business education. Each article is preceded by editorial comments and the preface and appendix include a biographical sketch and highlights Graham's career.

Harold Q. Langenderfer is Peat Marwick Professor of Professional Accounting at the University of North Carolina and Grover L. Porter is Professor of Accounting at the University of Alabama in Huntsville.

MALCOLM C. MILLER and M. ATIQUL ISLAM, *The Definition and Recognition of Assets* (Caulfield, Australia: Australian Accounting Research Foundation, 1988, pp. viii, 134, paper).

This study, which is *Accounting Theory Monograph 7*, was prepared within the context of the conceptual framework project of the Australian Research Foundation. It begins with a survey of definitions of assets including types of asset and criteria, meaning in economics and legal definitions, and then surveys the accounting literature, discussing Sprague, Paton, Canning, Sanders, Hatfield and Moore, Gilman, Paton and Littleton, American Institute of Accountants, Vatter, American Accounting Association, Staubus, Sprouse and Moonitz, Chambers, Ijiri, Lall, AICPA, FASB, Anthony, Arthur Andersen & Co., Sorter and Ingberman, Skinner, and others. The other chapters deal in detail with conceptual issues relating to the characteristics of assets, criteria for the recognition of assets, and the applications of the concepts to executory contracts, commitments for expenditures, leases, contingencies, and deferred debits. There is also a chapter dealing with intangibles.

Malcolm C. Miller is Associate Professor of Accounting and M. Atiqul Islam is Lecturer in Accounting at the University of New South Wales.

WALTER REID and D. R. MYDDELTON, *The Meaning of Company Accounts*, Fourth Edition (Aldershot, England and Brookfield, VT: Gower Publishing Company Limited, 1988, pp. ix, 351, $58.95).

Intended to provide managers with an understanding of financial statements and how they relate to the business' operations. Book is reader-interactive. Each of 11 sections provides problems and solutions which reader may work through. Introduction and Sections 1 and 2 present general accounting issues, the structure of the financial statements, and formal techniques and approaches of statement analysis. Sections 3–10 deal at length with theoretical and practical problems of recording transactions and measuring income and expenses, and assets and liabilities. Topics discussed include fixed assets and depreciation, company taxation, capital structure, group accounts, and inflation accounting. Last section provides an overview of how to analyze and interpret financial statements.

Walter Reid is a Director of Management Development Associates Limited and a Visiting Professor at the London Business School. D. R. Myddelton is a Professor of Finance and Accounting at the Cranfield School of Management.

TERRY K. SHELDAHL, Editor, *Education for the Mercantile Counting House*, Foundations of Accounting Series (New York and London: Garland Publishing, Inc., 1989, pp. xxiv, 412, $60.00).

Examines the role of liberal arts, in the curriculum of studies for prospective merchants in eighteenth century Britain. Chapter one presents a broad historical survey of the British education system from Anglo-Saxon times to 1800. Chapters 2 through 10 reproduce essays published in the 1700s. Each is prefaced by a brief sketch of the author and provides historical perspective. Reprinted items include: Thomas Watts, "An Essay on the Proper Method for Forming the Man of Business" (1716); Martin Clare, "Youth's Introduction to Trade and Business" (1719); William Webster, "An Essay on Bookkeeping According to the True Italian Method of Debtor and Creditor" (1726); Unsigned essay, "The Accomplish'd Merchant" (c. 1730); Monsieur Savary, Malachy Postlethwayt, translator, "The Universal Dictionary of Trade and Commerce" (1751-1755); Reverend William Thom, "The Defects of An University Education and its Unsuitableness to a Commercial People" (1762); William Gordon, "The Universal Accountant and Complete Merchant" (1763); H. Clarke and the Reverend W. Augustus Clarke, "Plan of the Literary, Commercial and Mathematical School, Mount Pleasant (Martindale Hill) Liverpool" (1793); William Milns, "Plan of Instruction by Private Classes" (1794); and Joseph Priestly, "Lectures on History and General Policy" (1765).

Terry K. Sheldahl is an Associate Professor of Accounting at the Savannah State College.

TERRY K. SHELDAHL, Editor, *Accounting Literature in the United States Before Mitchell and Jones (1796)*, Foundations of Accounting Series (New York and London: Garland Publishing, Inc., 1989, pp. xii, 510, $65.00).

An anthology of eighteenth-century United States accounting literature. Volume relates closely to Bentley and Leonard's authoritative bibliography (1934-1935) and the McMickle and Jensen bibliography published in 1988. Reproduces the principal pre-1796 titles identified in the McMickle and Jensen book. Introductory chapter provides biographical sketches of the authors and discusses two major areas for further bibliographical study. The reproductions are George Fisher, "The Secretary's Guide or Young Man's Companion" (1737); Charles Hutton, "A course of Bookkeeping According to the Method of Single Entry" (1788); Thomas Sargeant, "Elementary Principles of Arithmetic" (1789); Samuel Freeman, "The Town Officer" (1791); Thomas Sargeant, "The Federal Arithmetician or, The Science of Numbers Improved" (1793); Thomas Dilworth, "The Young Bookkeepers's Assistant: Showing Him in the Most Plain and Easy Manner the Italian Way of Stating Debtor and Creditor" (1794); and Reverend Richard Turner's, "A New Introduction to Bookkeeping after the Italian Method" (1794).

Terry K. Sheldahl is an Associate Professor of Accounting at the Savannah State College.

E. RAYMOND SIMPSON, JULES M. CASSEL, JILL PEPERONE GILES, and GREGORY J. JONAS, *A Guide to Implementation of Statement 96 on Accounting for Income Taxes* (Norwalk, CT: Financial Accounting Standards Board, 1989, pp. vii, 147, $16.00 paper).

Serves as an aid to understanding and implementing Statement 96 on Accounting for Income Taxes. Questions and answers are organized by the general topic in Statement 96 to which the questions relate. Selected answers are supplemented with illustrations. Topical index and cross reference by Statement 96 paragraph numbers are provided. Appendix reprints the full text of the standards section and Appendix A.

Editor's Note: Heidi Cunnick assisted the editor in annotating these books.

Books Received from March 1, 1989 to May 10, 1989

Wagdy M. Abdallah, *International Transfer Pricing Policies* (New York; Westport, CT; and London: Quorum Books, 1989, pp. viii, 170, $42.95).

Jane B. Adams, Ronald J. Bossio, and Paul Rohan, "Accounting for Contributed Services: Survey of Preparers and Users of Financial Statements of Not-for-Profit Organizations," *Financial Accounting Standards Board: Special Report* (Norwalk, CT: Financial Accounting Standards Board, pp. vii, 54, $12.00 paper).

J. Batty, *Accounting for Research and Development*, Second Edition (Aldershot, England and Brookfield, VT: Gower Publishing Company Limited, 1988, pp. xiii, 238, $69.95).

Germain Böer, *Use of Expert Systems in Management Accounting* (Montvale, NJ: National Association of Accountants, 1989, pp. xi, 55, $13.95).

Canadian Institute of Chartered Accountants, *Audit of Real Estate Operations* (Toronto: The Canadian Institute of Chartered Accountants, 1988, pp. 110, $15.00 paper).

John S. Chandler and H. Peter Holzer, Editors, *Management Information Systems* (Oxford: Basil Blackwell Ltd. and New York: Basil Blackwell, Inc., 1989, pp. viii, 179, $39.95).

John J. Clark, Thomas C. Chiang, and Gerard T. Olson, *Sustainable Corporate Growth* (New York; Westport, CT; and London: Quorum Books, a Division of Greenwood Press, Inc., 1989, pp. xiv, 298, $49.95).

Peter W. Crouch, "Travel Agents," *Business Briefing No. 9*, Winter 1988–1989 (London: The Institute of Chartered Accountants in England and Wales, 1989, pp. 24, £6.00 paper).

Financial Accounting Standards Board, *Employers' Accounting for Postretirement Benefits Other Than Pensions*, Financial Accounting Series: Exposure Draft, Proposed Statement of Financial Accounting Standards (Norwalk, CT: Financial Accounting Standards Board, 1989, pp. 212, $125 one year subscription–paper).

Alan Gart, *An Analysis of the New Financial Institutions* (New York; Westport, CT; and London: Quorum Books, 1989, pp. xx, 376, $59.95).

Nicholas V. Gianaris, *Contemporary Public Finance* (New York; Westport, CT; and London: Praeger Publishers, 1989, pp. xvi, 269, $49.95).

J. M. Juran, *Juran on Leadership for Quality* (New York and London: The Free Press, 1989, pp. vii, 376, $35.00).

Harold Q. Langenderfer and Grover L. Porter, Editors, *Rational Accounting Concepts: The Writings of Willard J. Graham*, Foundations of Accounting Series (New York and London: Garland Publishing, Inc., 1988, pp. xvi, 508, $40.00).

Thomas E. McKee, *Modern Analytical Auditing* (New York; Westport, CT; and London: Quorum Books, a Division of Greenwood Press, Inc., 1989, pp. xi, 160, $45.00).

Malcolm C. Miller and M. Atiqul Islam, *The Definition and Recognition of Assets* (Caulfield, Australia: Australian Accounting Research Foundation, 1988, pp. viii, 134, paper).

Melvin Morgenstein, *Career Accounting Fundamentals* (San Diego; New York; Chicago; Austin; Washington, D.C.; London; Sydney; Tokyo; and Toronto: Harcourt Brace Jovanovich, Publishers, 1989, pp. xiv, 559, $23.00).

Lee D. Parker, Editor, *Financial Reporting to Employees*, Foundations of Accounting Series (New York and London: Garland Publishing, Inc., 1988, pp. xviii, 247, $35.00).

Walter Reid and D. R. Myddelton, *The Meaning of Company Accounts*, Fourth Edition (Aldershot, England and Brookfield, VT: Gower Publishing Company Limited, 1988, pp. ix, 351, $58.95).

Myron J. Roomkin, *Managers as Employees* (New York and Oxford: Oxford University Press, 1989, pp. xiv, 288, $29.95).

Terry K. Sheldahl, Editor, *Education for the Mercantile Counting House*, Foundations of Accounting Series (New York and London: Garland Publishing, Inc., 1989, pp. xxiv, 412, $60.00).

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E. Raymond Simpson, Jules M. Cassel, Jill Peperone Giles, and Gregory J. Jonas, *A Guide to Implementation of Statement 96 on Accounting for Income Taxes* (Norwalk, CT: Financial Accounting Standards Board, 1989, pp. vii, 147, $16.00 paper).

George J. Staubus, *Activity Costing for Decisions*, Foundations of Accounting Series (New York and London: Garland Publishing, Inc., 1989, pp. xxix, 255, $35.00).

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The deadline for information to be included in the "Placement Information" section is two months prior to the date of publication. The REVIEW *is published on the first day of January, April, July, and October. Placement advertising and replies should be sent to the American Accounting Association, 5717 Bessie Drive, Sarasota, FL 34233. ATTENTION: ADVERTISING DEPT. All replies to box numbers should be on separate sheets to facilitate forwarding. There is no charge for this service to AAA members and associate members seeking employment. Others will be charged a fee of $150 per insertion. ADS SHOULD NOT EXCEED 150 WORDS.*

#401 THE UNIVERSITY OF TOLEDO. The Department of Accounting invites applications for positions in financial accounting, managerial accounting, and taxation, effective September 1989 or January or September 1990. Candidates should possess a doctorate with a specialty in accounting. Persons holding the combination of JD, MBA, CPA will also be considered for the tax position. Salary for the appointment is very competitive. The University of Toledo has an enrollment of approximately 20,000 students. The Accounting Department offers an undergraduate degree in accounting, as well as a Master of Science in Accounting degree, a Master of Taxation degree and the MBA. Send vita to: Dr. Larry F. Konrath, Chairman, Department of Accounting, The University of Toledo, Toledo, OH 43606. Equal Opportunity/Affirmative Action Employer.

#402 LEHIGH UNIVERSITY invites applications for tenure-track positions. Although preference will be given to applicants at the assistant professor level, candidates for associate professor who show evidence of substantial teaching and research productivity will also be considered. Candidates must have a Ph.D., D.B.A., or be near completion. We seek permanent faculty for the Fall of 1990. We are also prepared to consider appointments for 1989–1990. While applicants' research and teaching interests may be in any area, we are especially interested in those concentrating in taxes, systems, and auditing. The Department seeks a balance between teaching performance and research productivity. Our undergraduate programs are fully accredited, including Type A accounting accreditation, as is our MBA program. Applications received after November 15, 1989 cannot be assured of consideration. Contact: Kenneth P. Sinclair, Chair, Department of Accounting, Lehigh University, Drown Hall 35, Bethlehem, PA 18015. Lehigh is an Equal Employment Opportunity/Affirmative Action Employer.

#403 POSITION WANTED: PhD/CPA, mid-forties, with numerous publications including three books and several refereed professional journal articles, seeks position of full professor with tenure at AACSB-accredited university (or school aggressively seeking accreditation). Teaching and publishing interests are financial accounting and auditing. Desires school that rewards teaching excellence and publishing. Current salary mid-seventies and tenure at full rank. Available Fall 1990.

#404 APPLICATIONS FOR POSITIONS IN ACCOUNTING, at all professorial ranks, are invited from qualified persons. A Ph.D. is required. Demonstrated ability or potential for effective teaching and quality research are important considerations. The University of Pennsylvania is an equal opportunity/affirmative action employer. Interested persons should send their resumé including educational background, professional experience, publications, personal data, and, if applicable, a dissertation proposal and abstract to: Professor Robert E. Verrecchia, Accounting Department, University of Pennsylvania, Suite 2400, Steinberg Hall-Dietrich Hall, Philadelphia, PA 19104-6365.

#405 FACULTY POSITION: Applications are being sought for a tenure-track position in financial accounting at Southwest Texas State University for Fall 1990, at the Assistant/Associate Professor rank. Ph.D./D.B.A. in Accounting (or ABD) required. For Associate Professor, a track record of scholarly research must be demonstrated or at Assistant Professor, the potential for quality teaching and research. Send applications (resumé, transcripts, three letters of reference) to: DR. BILL BISHOP, Department of Accounting, SWTSU, San Marcos, Texas 78666. Telephone (512) 245-2566. Closing date January 1, 1990.

#406 CHAIR POSITION: The Department of Accounting at Southwest Texas State University invites applications for the position of Chair, effective September 1, 1990, at the Associate Professor/Professor rank at a 12-month competitive salary. Ph.D./D.B.A. in Accounting and five years of full-time teaching experience in Accounting is required. A track record of scholarly research is expected. Business/industry experience is desirable as well as business/academic administrative experience. The Department of Accounting is one of four departments in the School of Business and has 20 FTE faculty and approximately 500 majors at the junior-senior level. Send applications (resumé, transcripts, three letters of reference) to: Chair, Search Committee, Department of Accounting, SWTSU, San Marcos, Texas 78666. Telephone (512) 245-2566. Closing date January 15, 1990.

#407 THE UNIVERSITY OF DELAWARE, Department of Accounting is recruiting an accounting/accounting information systems person capable of both quality research and teaching. We consider ourselves to be a "balanced" college and university where teaching and research are rated equally. We have a high quality undergraduate student population, AACSB-accredited undergraduate and MS/Accounting Program, a dedicated faculty, reasonable research expectations, very good professional relationships, and opportunities. Contact: Dr. William Markell, Chairperson, Department of Accounting, College of Bus. & Ec., UNIVERSITY OF DELAWARE, Newark, DE 19716. THE UNIVERSITY OF DELAWARE IS AN EQUAL OPPORTUNITY EMPLOYER WHICH ENCOURAGES APPLICATIONS FROM MINORITY GROUPS AND WOMEN.

#408 COLUMBIA UNIVERSITY has one of two tenure-track positions to be filled for 1990-1991. Appointment(s) at either nontenured or tenured level(s), depending on qualifications. Send resumé and research paper to: Professor James Ohlson, 612 Uris Hall, Columbia University, New York, NY 10027. Columbia University is an AA/EEO employer and particularly interested in receiving applications from qualified women and members of minority groups.

#409 UNIVERSITY OF NORTH TEXAS is seeking applicants for expected accounting faculty positions for the 1990-1991 year. All positions are tenure-track. Minimum qualifications: Ph.D. or DBA in Accounting (ABD considered if dissertation in process). Undergraduate and graduate-level teaching. Salary is competitive. Send resumé to: Teddy L. Coe, University of North Texas, Department of Accounting, P.O. Box 13677, Denton, Texas 76203-3677. UNT is an Equal Opportunity Affirmative Action Employer.

#410 UNIVERSITY OF NORTH TEXAS is seeking to fill the Institute Chair and the position of Director of Petroleum Accounting. Candidates should possess an earned doctorate, ability to develop and direct research in the petroleum accounting area, maintain and strengthen relations with the petroleum industry and energy-related governmental and regulatory units. Detailed position description available upon request. Send resumés and inquiries to: Teddy L. Coe, University of North Texas, Department of Accounting, P.O. Box 13677, Denton, Texas 76203-3677. UNT is an Equal Opportunity Affirmative Action Employer.

#411 LYNCHBURG COLLEGE in Central Virginia is seeking applicants for a tenure-track position in Accounting at the assistant or associate professor level. Ph.D. or D.B.A. preferred; CPA and Master's Degree in Accountancy required. Specialization in auditing and financial accounting strongly preferred. Position requires quality teaching and advising of undergraduates; some MBA courses. The College is a coeducational, liberal arts institution of 1,900 undergraduate students, with roughly 25 percent business majors in accounting, management, and marketing. Send letter of application, vita, names of three references, and evidence of teaching effectiveness and professional development activity to: Professor Gerald Rosson, School of Business, Lynchburg College, Lynchburg, VA 24501. Deadline: October 15, 1989. Lynchburg College invites applications from women and from members of minority groups. EOE.

#412 CHAPMAN COLLEGE. Two tenure-track positions for Fall 1990. Assistant/Full levels. Ph.D. (ABD considered for assistant level), demonstrated excellence in teaching, and a commitment to scholarship required. Additional resources available to support a continuing level of high quality research. Salaries commensurate with qualifications and experience. Chapman College is a small, private liberal arts/preprofessional college located 30 miles south of Los Angeles. The School of Business and Economics has 650 students at the undergraduate and graduate levels. Send curriculum vitae, evidence of qualifications, and three letters of reference by December 22, 1989 to: Dr. Raymond Sfeir, Associate Dean, School of Business and Economics, Chapman College, Orange, CA 92666. AA/EO

#413 CARNEGIE MELLON UNIVERSITY is searching for tenure-track faculty to teach accounting in graduate and undergraduate programs. Individuals should have training in the disciplines of economics, finance, mathematics and statistics, and in addition should have demonstrated the potential for excellence in research (in the case of entry-level positions) or a proven record of excellence in research (in the case of non-entry-level positions). Applicants should submit a current vitae and evidence of research such as publications, working papers, or dissertation proposal and chapters to: Professor Shyam Sunder, Graduate School of Industrial Administration, Carnegie Mellon University, Schenley Park, Pittsburgh, PA 15213-3890. Carnegie Mellon University is an equal opportunity/affirmative action employer with particular interest in identifying women and minority applications for faculty positions.

#414 CREIGHTON UNIVERSITY invites applications for the position of Assistant or Associate Professor of Accounting. Applicants should possess a Ph.D. or D.B.A. ABDs will be considered. We are particularly interested in applicants who are willing to commit to careers in the accounting and information systems domain. This commitment is expected in teaching, research, and professional involvement. Prior teaching and/or research in the systems area is desirable but not expected. Applicants must have taken core courses in the area of information systems in his or her graduate work. Selected applicant will be provided support to bring the commitment to fruition. Creighton offers an ideal environment and active support for professional development in the systems area. The accounting, undergraduate business, MBA, and Master of Computer Systems Management programs all are AACSB-accredited. Applications should be sent to: Professor Thomas J. Purcell, Chairman, Department of Accounting, College of Business Administration, Creighton University, 2500 California Street, Omaha, NE 68178-0130. Creighton University is an equal opportunity/affirmative action employer.

#415 CALIFORNIA STATE UNIVERSITY, NORTHRIDGE, invites applications for Assistant, Associate, Professor, and Lecturers of Accounting and MIS. Salary, $38,300 to $59,800 depending on qualifications. The Department has 1,000 students pursuing BS and MS degree options in Accountancy, MIS, and Taxation. CSUN is an Equal Opportunity/Affirmative Action, Title IX, Section 504 employer. Interested candidates, send resumés to: Dr. Robert L. Barker, Chair, Department of Accounting and MIS, School of Business, California State University, Northridge, Northridge, CA 91330. Application deadline: January 5, 1990, or until positions are filled, prior to August 30, 1990.

#416 STATE UNIVERSITY OF NEW YORK, College at Fredonia will have a Fall 1990 opening in financial accounting. The department has a 12-hour teaching load with two preparations, which may be reduced for research. Faculty have a three- or four-day teaching schedule, and salary is nationally competitive. Ph.D. preferred, but will consider ABD. Fredonia was ranked as the ninth best comprehensive college in the nation by *U.S. News* in its October 10, 1988 issue. The college is located on Lake Erie in beautiful upstate New York and Chautauqua County between and about 45 miles from both Buffalo, New York and Erie, Pennsylvania. Although all qualified applicants are encouraged to apply, Fredonia takes pride in the pursuit of its affirmative action objectives and especially encourages women, American Indians, Blacks, and Hispanics to consider this opportunity. Send vita to: Dr. James Hopson, Department of Business, SUNY at Fredonia, Fredonia, NY 14063.

#417 THE UNIVERSITY OF MICHIGAN-FLINT has openings for tenure-track faculty positions at all ranks starting in either September or January. Most interest areas can be accommodated, although preference will be given to candidates in auditing and accounting information systems. Professional certification is desirable. Responsibilities include quality teaching, research, and service. Candidates must have a doctorate or be in the last stages of ABD. Salary is competitive and fringe benefits are excellent. Candidates should send a resumé to: Dean Richard W. Fortner, School of Management, The University of Michigan-Flint, Flint, MI 48502-2186. Applications accepted until position is filled. AA/EOE.

#418 THE UNIVERSITY OF IOWA, DEPARTMENT OF ACCOUNTING. The Department of Accounting at the University of Iowa is seeking qualified applicants to fill permanent or visiting Assistant, Associate, and/or Full Professor positions beginning Fall 1990. Principal qualifications are: (1) terminal degree (Ph.D. or DBA); (2) genuine interest in accounting research and in working closely with undergraduate and graduate students; (3) Senior Professors must have established record of quality teaching and research with demonstrated competence in directing doctoral theses; and (4) all candidates must have long-term interest in teaching. Screening will begin upon receipt of a resumé sent to: Valdean Lembke, Head, Department of Accounting, College of Business Administration, University of Iowa, Iowa City, IA 52242. This announcement will remain open until all positions are filled. The University of Iowa is an equal opportunity and affirmative action employer.

#419 RICE UNIVERSITY, HOUSTON, TEXAS. The Jesse H. Jones Graduate School of Administration is seeking research-oriented faculty with primary teaching interests in Financial Accounting, Managerial Accounting, or Management Information Systems to fill tenure-track positions at the level of Assistant/Associate Professor beginning Fall 1990. A Ph.D. and evidence of high quality teaching and research are required. Rice University is an Equal Opportunity/Affirmative Action Employer. Send vita; copies of recent articles, working papers, or a dissertation proposal; and student evaluations of teaching to: Dr. Wilfred C. Uecker, Associate Dean for Academic Affairs, The Jesse H. Jones Graduate School of Administration, Rice University, P.O. Box 1892, Houston, Texas 77251-1892; (713) 527-4869.

#420 THE SCHOOL OF ACCOUNTING AT OKLAHOMA STATE UNIVERSITY seeks applicants for the Arthur Andersen & Co. Alumni Centennial Professorship. Applicants should possess a distinguished record of research and teaching and be capable of assuming a major role in the academic and professional mission of the School. Activities of the professor are expected to include conducting scholarly research, contributing to the research and teaching activities of faculty, and active participation in the doctoral program. The initial appointment is five years, renewable thereafter at three-year intervals. Benefits beyond the resources and privileges accorded School of Accounting faculty members, include a general salary supplement, a six-hour per semester teaching load, and summer research support for two of every three summers during the tenure of the appointment. Send resumé to: Dr. Lanny G. Chasteen, Search Committee Chairman, School of Accounting, Oklahoma State University, Stillwater, OK 74078-0555. OSU is an equal opportunity, affirmative action employer.

#421 GEORGETOWN UNIVERSITY, Washington, D.C. The School of Business Administration invites applications for a tenure-track position in Tax Accounting for Fall 1990. Candidates should have a strong commitment to excellence in teaching and research. Salary and fringe benefits are competitive. The School of Business Administration offers the B.S.B.A. degree, with a concentration in Accounting. On the graduate level, Georgetown University offers programs leading to the degrees of Master of Business Administration and Master of Science in Taxation. Georgetown University is an equal opportunity/affirmative action employer. Please send resumé and references to: Virginia N. Flavin, Director of Faculty Services, School of Business Administration, Georgetown University, Washington, D.C. 20057.

#422 THE STATE UNIVERSITY OF NEW YORK AT BUFFALO has September 1990 openings for Assistant, Associate, or Full Professors of Accounting. Fields of interest include financial accounting, managerial accounting, auditing, and accounting information systems, with teaching opportunities at undergraduate, M.B.A., and Ph.D. levels. Teaching load is six hours per semester. Candidates for an Assistant Professor position should have a strong interest in research and possess relevant research tools, and have an earned doctorate or be in the advanced stage of dissertation research by September 1990. Candidates for the Associate or Full Professor position should have a completed doctorate, an established research record, demonstrated teaching ability, and an ability to supervise doctoral students, and work with junior faculty. Salary and fringe benefits are competitive. The University is an Affirmative Action/Equal Opportunity Employer. Please send resumé to: Professor Joseph Weintrop, 335B Jacobs Management Center, State University of New York at Buffalo, Buffalo, New York 14260.

#423 USC COASTAL CAROLINA COLLEGE invites applications for a tenure-track position teaching advanced undergraduate courses in a rapidly growing four-year institution. Candidate must have Ph.D., D.B.A., or be in final dissertation stage. Business experience is desirable. Coastal Carolina College is a unit of the USC system located in the exciting Myrtle Beach area of South Carolina. Five majors are offered in an undergraduate business program which includes 16 full-time faculty. Please send letter of application and resumé to: Dr. Linda Henderson, Search Committee Chair, School of Business, USC Coastal Carolina College, P.O. Box 1954, Myrtle Beach, SC 29578. An Equal Opportunity, Affirmative Action Employer.

#424 UTAH STATE UNIVERSITY invites applications and nominations for the position of Head, School of Accountancy. Candidates should possess an earned doctorate in accounting, qualifications commensurate with rank of professor with tenure, an established record in research and publication, a demonstrated ability to work effectively with the professional community, and professional certification. Previous administrative and business experience is desirable. Salary is competitive and commensurate with qualifications and experience. Applicants should submit a resumé with names and addresses of three professional references. Screening will begin December 1, 1989. Nominations and applications may be sent to: Dr. John C. Cragun, Associate Dean, College of Business, Utah State University, Logan, Utah 84322.

#425 ACCOUNTING FACULTY: Virginia Commonwealth invites applicants for a tenure-track position in Accounting Information Systems/Managerial Accounting for Fall 1990. Applicants are required to have an appropriate doctorate or be nearing completion. Professional certification is preferred. Applicants for senior rank should have an established record of performance in research. Send inquiries to Chairman, Department of Accounting, VCU, Richmond, VA 23284-4000. Review of applications will begin on November 1, 1989 and continue until position is filled. VCU is an Equal Opportunity/Affirmative Action Employer and strongly encourages the application of minorities and women.

#426 THE UNIVERSITY OF PUGET SOUND School of Business and Public Administration invites applications for a tenure-track position in Accounting to begin August 1990 or earlier. Assistant or Associate Professor preferred; salary commensurate with eduation and experience. Teach intermediate and advanced managerial/cost accounting courses; some introductory courses also required. Ph.D. or D.B.A. (ABDs near completion will be considered) in Accounting, and commitment to undergraduate teaching. Preference will be given to applicants with C.P.A., C.I.A., or C.M.A. certificate, prior college-level teaching experience and related work experience. Send vita and names of three references to: Accounting Search, University Puget Sound, P.O. Box 7297, Tacoma, WA 98407. An Equal Opportunity, Affirmative Action Educator/Employer.

#427 THE DEPARTMENT OF ACCOUNTING, THE UNIVERSITY OF TEXAS AT AUSTIN, is recruiting at all academic ranks, for appointments starting September 1, 1990. Applicants should have superior records in Ph.D. or D.B.A. programs and potential for excellence in teaching and research. Salaries and fringe benefits are competitive. Submit vita, academic transcripts, references, and samples of research to: Dr. Robert G. May, Chairman, Department of Accounting, CBA 4M.202, The University of Texas, Austin, TX 78712-1172. The University of Texas at Austin is an Equal Opportunity Employer.

#428 UNIVERSITY OF MARYLAND AT COLLEGE PARK invites applications for faculty positions in Accounting. The minimum qualification for Assistant Professor is a Ph.D. degree. A candidate for Associate or Full Professor should have a distinguished publication record and a record of quality teaching. Interested candidates should send resumés to: Professor Martin P. Loeb, College of Business and Management, University of Maryland at College Park, College Park, MD 20742. The University of Maryland is an equal opportunity/affirmative action employer. Women and minorities are encouraged to apply.

#429 WRIGHT STATE UNIVERSITY invites applications for a tenure-track accounting position at the Assistant Professor level beginning September 1990. Candidates should possess a doctorate in accounting or be nearing completion of degree. Professional certification and teaching experience desirable. Salary competitive; excellent fringe benefits. Undergraduate Business and MBA programs are AACSB-accredited. Apply to: Jim Snavely, Chair, Department of Accountancy, College of Business, Wright State University, Dayton, Ohio 45435. (513) 873-2387. Application deadline: December 1, 1989 or until position is filled. Wright State is an EO/AA.

#430 INDIANA STATE UNIVERSITY is seeking a faculty member in Accounting for a tenure-track position beginning August 1990. Teaching interests may be in the Financial or Auditing areas. Earned doctorate with CPA or CMA certification is preferred; ABDs will be considered. Prior teaching experience is desirable but not necessary. Salary is competitive and would be based on individual's qualifications. Send resumé to: Dr. Henry Longfield, Chairman, Department of Accounting, Indiana State University, Terre Haute, Indiana 47809. Indiana State University is an equal opportunity/affirmative action employer.

#431 CALIFORNIA POLYTECHNIC STATE UNIVERSITY-SAN LUIS OBISPO seeks candidates for September 1990 appointment Assistant/Associate/Full Professor position; full-time. Primary need is managerial/cost area; others considered. Doctorate required. Professional certification preferred. Candidates must be committed to teaching excellence and professional development including research and publication. Rank and salary commensurate with experience. Contact: DR. JAMES ANDERSON, ACCOUNTING Department, School of Business, Cal Poly, San Luis Obispo, CA 93407. Closing date: January 1, 1990 or until filled. Cal Poly is an equal opportunity/ affirmative action employer and only hires individuals lawfully authorized to work in the U.S.

#432 COLLEGE OF MANAGEMENT. The University of Massachusetts at Boston seeks applicants for accounting faculty positions. Candidates should hold a Ph.D. or D.B.A. in Accounting; ABDs nearing completion will also be considered. Rank and salary are dependent on qualifications. CPA, CMA, or CIA would be a plus. The campus has modern facilities and is located at Boston Harbor. The College offers undergraduate and MBA programs, and emphasizes quality instruction and research. Salary, teaching load, and other benefits are very competitive. Apply by December 1, 1989 to: Dr. Lal C. Chugh, Chairman, Department of Accounting Finance, College of Management, University of Massachusetts/Boston, Harbor Campus, Boston, Massachusetts 02125. The University is an Affirmative Action/Equal Opportunity/Title IX Employer. Minorities and women are encouraged to apply.

#433 LOYOLA MARYMOUNT UNIVERSITY (LMU) invites applications for tenure-track positions in Financial and Cost/Managerial Accounting. Rank and salary are competitive and depend on experience. A completed doctorate in accounting is required, but consideration will be given to ABDs with teaching experience. Evidence of effective teaching will be sought. It is expected that you are capable and willing to engage in research leading to publication. Our undergraduate accounting program is one of the most highly regarded in Los Angeles. LMU is located near the ocean and the airport, convenient to all of the city's business centers. Please contact: Professor Frank Daroca, Department of Accounting, College of Business, LMU, Los Angeles, CA 90045. An Equal Opportunity, Affirmative Action Employer.

#434 CALIFORNIA STATE UNIVERSITY, LOS ANGELES is accepting applications from candidates for Assistant, Associate, and Full Professor tenure-track openings for 1990–1991. Tenure-track positions require a doctorate or ABD, except in taxation which requires a J.D. and MBT. Candidates should be able to demonstrate teaching effectiveness and research capabilities. The Department's needs are for persons who can teach financial and auditing (undergraduate and graduate). California State University, Los Angeles is an Equal Opportunity/Affirmative Action Employer. Interested candidates are invited to submit their curriculum vitae to: Dr. Lynn Rans, Chair, Department of Accounting, California State University, Los Angeles, CA 90032.

#435 DEPARTMENT CHAIR: TOWSON STATE UNIVERSITY, SCHOOL OF BUSINESS AND ECONOMICS. The Department of Accounting is seeking a chair commencing September 1, 1990. The chair provides leadership to 18 full-time faculty and should have an established record of teaching excellence, research, and service. The School of Business and Economics offers a B.S. in Accounting and is actively seeking AACSB-accreditation for business and accounting programs. Candidates must possess a doctorate in Accounting. The candidates must be willing and able to maintain a strong relationship with the professional accounting community and possess professional certification. Administrative experience desirable. Must possess credentials and research record to warrant appointment at the Associate or Professor level. Rank and salary are AACSB-competitive. Send vita by December 31, 1989 to: Dr. Sam Barone, Dean, School of Business and Economics, Towson State University, Baltimore, Maryland 21204. Review of applicants is in process and will continue until position is filled. Towson State University is an Affirmative Action, Equal Opportunity Employer.

#436 ACCOUNTING FACULTY POSITIONS: TOWSON STATE UNIVERSITY. The Department of Accounting is seeking tenure-track positions beginning in the Fall 1990 semester. Candidates must possess a doctorate with Accounting as the major area, professional certification, and appropriate record of research, and publications. The School of Business offers a B.S. in Accounting and is actively seeking AACSB accreditation for both its business and accounting programs. Rank: Assistant or Associate Professor depending on academic credentials and experience. Salary: AACSB-competitive. Send vita by December 31, 1989 to: Dr. Sam Barone, Dean, School of Business and Economics, Towson State University, Baltimore, MD 21204. Review of applicants is in process and will continue until position is filled. Towson State University, located on a 326-acre campus in a northern suburb of Baltimore, is a liberal arts based comprehensive university with an enrollment of approximately 15,000 undergraduate students, of which 4,000 are undergraduates in the School of Business and Economics. An Affirmative Action, Equal Opportunity Employer. Women and Members of Minority Groups are encouraged to apply.

#437 HEAD—DEPARTMENT OF ACCOUNTING, UNIVERSITY OF IDAHO. The Department of Accounting at the University of Idaho seeks applicants for Department Head beginning Fall 1990. Salary is competitive, depending on qualifications and experience. Doctorate in accounting; professional certification (CPA, CMA, etc.); demonstrated record of teaching, research and service accomplishments; and demonstrated leadership skills required. AACSB accounting accreditation experience desirable. The record of the applicant should qualify the individual as an associate or full professor. Applicants should be committed to development of a professional School of Accountancy. Applications should include a complete resumé, a brief statement of views of the role of department head, and three (3) letters of professional references. Contact: Jeffrey L. Harkins, Department of Accounting, University of Idaho, Moscow, ID 83843. (202) 885-6453. Closing date: Search and selection procedures will be closed when a sufficient number of qualified applicants have been identified, but not sooner than October 15, 1989. AA/EOE.

#438 APPALACHIAN STATE UNIVERSITY is seeking qualified applications for tenure-track positions beginning August 1990. Applicants should possess a doctoral degree or be at the dissertation stage. These positions will be at the Assistant Professor level. We are especially in need of Accounting Information Systems faculty. Appalachian is a member of the North Carolina System of Higher Education. The University is accredited by the AACSB. The Department of Accounting offers both the Bachelor's and Master's degrees. Candidates should send resumé to: Dr. Raymond L. Larson, Chairman, Department of Accounting, Walker College of Business, Boone, NC 28608. ASU is an Equal Opportunity Employer.

#439 CALIFORNIA STATE UNIVERSITY, FULLERTON invites applications for tenure-track and temporary appointments in Accounting. Candidates must have a doctorate in accounting or be near completion of dissertation. A strong commitment to teaching and research is expected. The School of Business is accredited by AACSB at the undergraduate and graduate levels. Rank and salaries are competitive and commensurate with professional experience and qualifications. Send applications to: Keith W. Lantz, Associate Dean, Department of Accounting, California State University, Fullerton, Fullerton, CA 92634. Telephone 714-773-2225. CSUF is an Affirmative Action, Equal Opportunity Employer.

#440 THE UNIVERSITY OF WISCONSIN–MILWAUKEE is seeking a tenure-track, Assistant Professor of Accounting for Fall 1990 in the following areas: (1) accounting systems, and (2) taxation. Candidates should possess a PhD degree, or be near completion. Summer teaching and research opportunities. Salary is competitive. Letter of application and resumé to: Dr. Paul M. Fischer or Dr. William A. Raabe, School of Business Administration, University of Wisconsin–Milwaukee, P.O. Box 742, Milwaukee, WI 53201. UWM is an Affirmative Action/Equal Opportunity Employer and is seeking applications from all qualified applicants, especially minorities and women.

#441 RUTGERS UNIVERSITY'S SCHOOL OF BUSINESS–CAMDEN invites applications from highly qualified candidates for tenure-track positions in Auditing and Financial Accounting. Rank and salary are commensurate with qualifications and experience. Research support is extensive. Normal teaching load is six hours per semester. Senior faculty members are encouraged to apply. Rutgers-Camden is located across the Delaware River from Philadelphia. The School of Business occupied a new building June 1989. Contact: Ira S. Greenberg, Assistant Dean, Rutgers University–Camden, School of Business, Camden, NJ 08102 or call (609) 757-6216.

#442 FREEMAN SCHOOL OF BUSINESS–TULANE UNIVERSITY invites applicants in accounting. Rank open. Candidates must hold an earned doctorate or expect completion by August 1990. Salary and teaching loads competitive. Senior candidates must have a strong research record. Junior candidates must have a strong research agenda. Quality teaching is expected. The Freeman School, located on the Uptown Campus of suburban New Orleans, has 40 tenure/tenure-track faculty members and 700 students in undergraduate and graduate programs. Tulane is an affirmative action, equal opportunity employer. Send vita and references to: Ronald C. Lease, Associate Dean, Freeman School of Business, Tulane University, New Orleans, LA 70118.

#443 SAN FRANCISCO STATE UNIVERSITY has tenure-track faculty openings in financial accounting and auditing. Experienced faculty are especially needed in auditing to help implement and coordinate courses and programs in this area. An appropriate doctoral degree or ABD status, professional experience, and/or certification are required. Faculty are expected to engage in instructional and professional activities, and research; major emphasis is on teaching effectiveness. Salary and rank dependent upon qualifications. The School of Business is accredited by the AACSB at both the undergraduate and graduate levels. Send vita to: Dr. Steven M. Mintz, Chair, Department of Accounting, School of Business, San Francisco State University, 1600 Holloway Avenue, San Francisco, California 94132. Closing date for applications is February 15, 1990. San Francisco State University is an Equal Opportunity/Affirmative Action Employer.

#444 THE UNIVERSITY OF MICHIGAN–DEARBORN, SCHOOL OF MANAGEMENT. The University of Michigan–Dearborn, servicing approximately 7,000 students, is strategically located on 210 acres of the original Henry Ford Estate in the Greater Detroit Metropolitan region. The School of Management, offering B.S.A., B.B.A., and M.B.A. degree programs, invites applications for accounting positions, available January or September 1990. Rank through Associate Professor available to candidates possessing a PhD/DBA, with CPA/CMA preferred; ABDs considered. The successful applicant will be dedicated to quality teaching, research, and service activities. Send letter of application, current resumé, graduate transcript, and three references to: Gail McCracken, Assistant Dean, School of Management, The University of Michigan–Dearborn, MI 48128-1491. Applications will be accepted until position is filled. The University of Michigan–Dearborn is an equal opportunity educator and employer and specifically encourages women and minority applicants.

#445 CALIFORNIA STATE UNIVERSITY, STANISLAUS anticipates one or two positions in Accounting at Assistant or Associate Professor level depending on qualifications. Undergraduate and MBA programs. Teaching excellence, scholarship, and professional activity required. Doctorate required or close to completion. CPA/professional certification desirable. Located in the San Joaquin Valley in a small city, 15 miles south of Modesto—a metropolitan area of approximately 200,000 people. Two-hour drive from San Francisco/High Sierras, three hours/Lake Tahoe. Low housing cost relative to major California cities. Cal State Stanislaus is an Affirmative Action/Equal Opportunity/Title IX/Section 504 Employer. Citizens/permanent residents only. Direct applications to: Dr. Gerald Nichols, Chairman, Department of Accounting and Finance, School of Business, California State University, Stanislaus, Turlock, CA 95308. (209) 667-3671.

#446 CALIFORNIA STATE UNIVERSITY, SACRAMENTO has accounting faculty openings, effective August 1990, in it's accredited AACSB undergraduate and master programs. Salary and rank are open. For tenure-track positions, applicants must hold a doctoral degree with specialization in accounting, or ABD with expectation of completion within the first semester of appointment. Candidates must complete all degree requirements by February 1, 1992 for continuation of appointment. Professional experience, a current record of scholarly activity, and/or certification are desirable. Primary emphasis is on teaching effectiveness; research and scholarly activities are required. Visiting professors must hold a doctoral degree with specialization in accounting and have extensive academic experience with a current record of scholarly activity or extensive professional experience. Send application letter and resumé to: Eugene Sauls, Chair, Department of Accountancy, School of Business Administration, CSUS, CA 95819-2694. The Department will begin to review applications on September 30, 1989 until each position is filled. The closing date for applications is March 1, 1990.

#447 KENT STATE UNIVERSITY. Tenure-track accounting positions for 1990–1991. PhD or DBA required; ABD (advanced stages) considered for initial non-tenure-track appointment. CPA and/or CMA desirable. Specialties in all areas of accounting considered; primary needs are in accounting systems and taxation. Qualified minority and female candidates are encouraged to apply. Review of applications will begin November 6, 1989, and positions will be filled as acceptable candidates are identified; final application deadline is January 15, 1989. Visiting positions considered if tenure-track positions are not filled. Send resumés to: Dr. David Fetyko, Chairman, Department of Accounting, 434 BSA, Kent State University, Kent, OH 44224. (216) 672-2545. Kent State is an AA/EO Employer.

#448 LOUISIANA STATE UNIVERSITY, Department of Accounting, anticipates faculty openings for the Fall of 1990. Available openings are at the assistant, associate, and full ranks. Assistant candidates should have a doctorate or be near completion of their doctoral program. Applicants at the upper ranks must have a commensurate research and professional service record. Faculty are generally expected to teach six hours per semester and be actively involved in research and professional service. Salary is commensurate with qualifications and experience. The University is an Equal Opportunity, Affirmative Action Employer. Please send resumés and references to: Dr. Vincent C. Brenner, Chairman, Department of Accounting, 3101 CEBA Bldg., College of Business Administration, Louisiana State University, Baton Rouge, LA 70803.

#449 SUFFOLK UNIVERSITY, Boston, MA. The Accounting Department, School of Management, anticipates a full-time tenure-track position opening, effective Fall 1990, at undergraduate/graduate levels in managerial and/or financial areas with secondary interests in AIS or auditing. A PhD/DBA in Accounting and evidence of effective teaching, research, and a strong record of publication are required: CPA, CMA, and/or other certification(s) required. The undergraduate/graduate business programs offered by the School are accredited by AACSB. For information, contact: Professor Morris McGinnis, Chairperson of Accounting, (617) 573-8341. Submit application/academic vita to: Ronald Sundberg, Associate Dean, School of Management, Beacon Hill, Boston, MA 02108. (617) 573-8301. An Equal Opportunity, Affirmative Action Employer.

#450 VIRGINIA COMMONWEALTH UNIVERSITY invites applications for the position of Chair, Department of Accounting, effective August 15, 1990. VCU, a fully AACSB-accredited institution with a growing national reputation, has approximately 20,000 students, with over 4,000 enrolled in the School of Business and 600 accounting majors. Accounting accreditation for undergraduate and graduate programs was received in 1984. Applicants must have a doctorate, and established record of research, and a commitment to teaching excellence. Candidates should qualify for the rank of Professor or Associate Professor with tenure and must be able to communicate effectively with the professional community. Application review begins on November 15, 1989 and continues until the position is filled. VCU is an Equal Opportunity, Affirmative Action Employer and strongly encourages applications from minorities and women. Applicants should send a resumé and references to: John Everett, Search Committee Chair, Department of Accounting, Virginia Commonwealth University, Richmond, VA 23284-4000.

#451 THE AMERICAN UNIVERSITY IN CAIRO invites applications for two possible vacancies for Assistant, Associate, or Full Professors to teach, in English, undergraduate and graduate (MBA) courses in: (1) elementary, intermediate, and advanced financial accounting, auditing, and taxation; and (2) international business and international finance. Ph.D. required. Two-year appointments (renewable) beginning September 1990. Rank, salary according to qualifications and experience. For expatriates, housing, roundtrip air travel, plus schooling for two children included. Write with curriculum vitae, preferably before December 15, 1989 to: Dean George H. Gibson, The American University in Cairo, 866 United Nations Plaza, Suite 517, New York, New York 10017-1889.

#452 UNIVERSITY OF NEW ORLEANS invites applications for the position of Assistant, Associate, or Professor of Accounting in systems and/or managerial. Candidates should have the Ph.D. or DBA degree (accounting major). Individuals must have an established record of scholarly research and a commitment to quality teaching. Salary is negotiable and competitive. The University offers the M.S. in Accounting and the M.S. in Accounting (tax option), as well as the M.B.A. Approximately 550 undergraduate accounting majors are enrolled. The University has AACSB-accreditation at both the graduate and undergraduate levels. Candidates should send resumé to: Professor Gordon A. Hosch, Chairman, Department of Accounting, College of Business Administration, University of New Orleans, New Orleans, LA 70148. UNO is an Affirmative Action, Equal Opportunity Employer.

#453 PITTSBURG STATE UNIVERSITY is seeking financial accounting or tax faculty at the Assistant or Associate Professor rank for a 1990–1991 anticipated opening. Ph.D. or DBA required. Candidates should have a strong interest in research, publication, and effective teaching. Rank and salary depend upon qualifications and offers will be competitive. Pittsburg State University is located in southeast Kansas equidistant from Kansas City, MO, Wichita, KS, and Tulsa, OK. Pittsburg, KS is also close to the Missouri and Arkansas mountains and lake recreational areas. Send vita by January 1, 1990 to: Donald M. Cash, Chairman, Department of Accounting, Kelce School of Business and Economics, Pittsburg State University, Pittsburg, Kansas 66762. PSU is an equal opportunity, affirmative action employer.

#454 CALIFORNIA STATE UNIVERSITY, LOS ANGELES is accepting applications from candidates for Assistant, Associate, and Full Professor tenure-track openings for 1990–1991. Tenure-track positions require a doctorate or ABD, except in taxation which requires a J.D. and MBT. Candidates should be able to demonstrate teaching effectiveness and research capabilities. The Department's needs are for persons who can teach financial and auditing (undergraduate and graduate). California State University, Los Angeles is an Equal Opportunity/Affirmative Action Employer. Interested candidates are invited to submit their curriculum vitae to: Dr. Lynn Rans, Chair, Department of Accounting, California State University, Los Angeles, CA 90032.

#455 BOWLING GREEN STATE UNIVERSITY is seeking applicants for tenure-track positions (assistant or associate) and temporary instructors in accounting starting August 1990. Requirements for the tenure-track positions are a Ph.D. or equivalent (or an advanced-stage ABD at the assistant level) and a commitment to research and teaching. Associate candidates must have a commensurate teaching, research, and service record. Applicants with primary emphasis in accounting systems, auditing, and financial accounting are urged to apply. Instructor applicants should hold an appropriate Master's degree and professional certification. The University, a state-supported institution with 16,000, is located 25 miles south of Toledo. Applications and inquiries should be directed to: Professor T. Evans, Chair, Department of Accounting and MIS, Bowling Green State University, Bowling Green, Ohio 43403. Bowling Green is an Equal Opportunity/Affirmative Action Employer. Minorities and Females are Encouraged to Apply.

#456 SAINT JOSEPH'S UNIVERSITY seeks applicants for accounting faculty positions. Rank is dependent on candidate's qualifications. Salaries are competitive, fringe benefits are excellent. Candidates should hold a doctorate in accounting or ABD with substantial progress toward completion. CPA or CMA is a plus. The Department desires well-balanced performance by its faculty, including teaching excellence, publications, and service. Saint Joe's is located in historic Philadelphia and is a short drive from New York, Washington, and the New Jersey shore. Apply to: Prof. Joseph M. Ragan, Chairman, Department of Accounting, College of Business and Administration, Saint Joseph's University, Philadelphia, PA 19131-1395. Telephone (215) 660-1650. Saint Joseph's University is an equal opportunity, affirmative action employer. Qualified minorities and women are encouraged to apply.

#457 AMERICAN UNIVERSITY, WASHINGTON, D.C. Applications are invited for two tenure-track accounting faculty positions. One position is designated for a TAXATION specialist qualified to teach in our highly regarded M.S. in Taxation program. The second position is intended for a FINANCIAL, MANAGERIAL, or AUDITING specialist. Applicants must be effective teachers with a serious commitment to scholarship and professional service. An appropriate doctorate (or LLM in taxation) is required. Professional certification (CPA) is highly desirable for both positions. All ranks will be considered. Appointments at senior ranks normally require four years of service at TAU before tenure consideration. Research and professional opportunities in the nation's capital are excellent. Applications should be sent to: Dr. Philip F. Jacoby, Chair, Accounting Department, Kogod College of Business Administration, The American University, Washington, D.C. 20016. The American University is an equal opportunity, affirmative action employer. Applications from women and minorities are especially invited.

#458 DEPAUL UNIVERSITY'S SCHOOL OF ACCOUNTANCY invites applications from highly qualified candidates for tenure-track positions in Auditing, Managerial Accounting, and/or MIS. Rank and salary commensurate with qualifications and experience. Doctorate preferred for all positions; ABD within one year of completion will be considered. Evidence of consistent teaching excellence and scholarly capabilities and accomplishments are essential. Research support is extensive. The School is fully accredited by the AACSB, is an FAS charter member, and offers two undergraduate and six graduate programs to 2,000 accounting students. Located in Chicago's commercial district, DePaul offers significant research and professional opportunities. Please contact: Dr. John T. Ahern, Jr., Director, School of Accountancy, DePaul University, 24 E. Jackson Blvd., Chicago, IL 60604-2287. (312) 341-8770. DePaul is an EEO employer.

#459 ACCOUNTING/INTERDISCIPLINARY STUDIES: Guilford College, Assistant Professor, tenure-track position beginning Fall 1990. Strong commitment to teaching undergraduates at a small liberal arts college; interest in financial accounting and in teaching and participating in the development of interdisciplinary courses. Doctorate (any major) and CPA preferred. Guilford is a selective, coeducational Quaker liberal arts college. Guilford College is an Affirmative Action/ Equal Opportunity Employer. We actively seek applications from women and minorities. Send state of interest and vita by November 30, 1990 to: Dr. Sam Schuman, Academic Dean, Guilford College, Greensboro, NC 27410.

#460 FLORIDA ATLANTIC UNIVERSITY seeks applicants for faculty positions in financial and auditing and may consider systems and tax. New Ph.D. program creates need for faculty who have experience working with doctoral students; so Professors and Associates will be given preference over Assistants. Candidates beyond accepted dissertation proposal may be considered for Assistant. Ph.D./DBA, published research necessary for all others. Send resumé and reference list to: Robert D. Taylor, Director, School of Accounting, Florida Atlantic University, Boca Raton, FL 33431-0991 before November 15, 1989.

#461 TENURE-TRACK POSITIONS for the 1990–1991 Academic Year. Administrative responsibilities may be included. Rank and salary depend on academic preparation and experience. Ph.D. or ABD required for tenure-track appointment. Our program includes a five-year Professional Accountancy Program in addition to baccalaureate curriculum. Send letter of application, vita, three (3) letters of reference and transcripts by November 1, 1989 to: Dr. Charles J. Pineno, Chair, Department of Accountancy, College of Business Administration, Clarion University of Pennsylvania, Clarion, PA 16214. EOE.

#462 THE UNIVERSITY OF ALABAMA AT BIRMINGHAM (UAB) is seeking applications for appointment at the Associate or Full Professor level in Accounting. Applicants should possess a Ph.D. or D.B.A.; CPA or CMA desirable. Applicants must have considerable teaching experience and demonstrated ability in high quality research, publication, and involvement in professional organizations. Experience in public or private accounting is highly desirable. Preferably, the individual would be qualified as a candidate for Department Chair in the short term future. The University of Alabama at Birmingham is a comprehensive urban university with about 15,000 students. The Accounting Department has separate AACSB accounting accreditation of its undergraduate and master's programs. Contingent on funding, the position (visiting or permanent) is available for 1990–1991. UAB is an Equal Opportunity/Affirmative Action Employer. Contact: Dr. Loudell Robinson, UAB, Department of Accounting, UAB Station, Birmingham, Alabama 35294.

#463 THE COLLEGE OF WILLIAM AND MARY invites applications for a tenure-track position as Assistant Professor of Accounting, effective September 1990. Candidates must have or be completing a PhD or DBA degree. All faculty members are expected to be involved in both teaching and research. The teaching responsibilities will be in both the undergraduate and MBA programs. The College of William and Mary is a state-supported university of approximately 7,000 students. Our students are outstanding with average SAT scores exceeding 1,200. The accounting program is accredited by AACSB. Deadline date for applications is December 31, 1989. Send resumé to: Dr. James E. Smith, Director of the Accounting Program, School of Business Administration, College of William and Mary, Williamsburg, VA 23185. Minorities and women are encouraged to apply. The College of William and Mary is an affirmative action/equal opportunity employer.

#464 FORT LEWIS COLLEGE, Durango, Colorado will have a tenure-track faculty position emphasizing Auditing and Introductory Financial/Managerial Accounting, beginning September 1990. Appropriate doctorate required, professional certification, and demonstrated teaching excellence desirable. Some research expected, typical teaching load is three courses per term. The academic year is eight months. Fort Lewis, a four-year undergraduate liberal-arts institution, is accredited by the AACSB. Send application letter and resumé to: Dr. Joe Colgan, Accounting Search Committee, School of Business Administration, Fort Lewis College, Durango, Colorado 81301. Closing date: November 3, 1989 or until filled. Fort Lewis College is an EEO/AA employer.

#465 DEPARTMENT OF ACCOUNTING. One tenure-track position available commencing Summer or September 1990. Applicants should possess a Ph.D., a D.B.A., or an ABD in Accounting. Rank and salary depend on qualifications. The normal teaching load is 12 hours with two preparations but reduced teaching loads for research are available. Application deadline is November 30, 1989 or until the position is filled. Send letter of application and resumé to: Chairperson, Accounting Department Search Committee, 325 Shippen Hall, Shippensburg University, Shippensburg, PA 17257. SHIPPENSBURG UNIVERSITY IS AN EQUAL OPPORTUNITY/AFFIRMATIVE ACTION EMPLOYER. QUALIFIED WOMEN AND RACIAL MINORITIES ARE ENCOURAGED TO APPLY.

#466 ASSISTANT PROFESSOR, ACCOUNTING. The University of Rhode Island Department of Accounting invites applications for two tenure-track positions for Fall 1990 academic year. Candidates should have a strong commitment toward quality research and teaching. Primary areas of need are financial, taxation, systems, and auditing. URI is accredited by AACSB. Salary and benefits are competitive. Ph.D/D.B.A. with accounting concentration or ABD near completion required. CPA/CMA preferred. Application deadline is January 1, 1990. Applicants should submit a resumé to: Spencer J. Martin, Search Committee Chair, Assistant Professor, Accounting (040114) Position, THE UNIVERSITY OF RHODE ISLAND, P.O. Box G, Kingston, RI 02881. An Affirmative Action/Equal Opportunity Employer.

#467 SOUTHEAST MISSOURI STATE UNIVERSITY is seeking qualified faculty in ACCOUNTING for Fall 1990. Qualifications: a doctorate in Accounting, classroom excellence, professional growth potential, and enjoy relating to students, faculty, and business community. Certification (CPA/CMA) is desirable. Compensation is competitive. The Department has a progressive, strong program with approximately 550 majors. Cape Girardeau is a "Best Town in America" with a population of 35,000. Review of applicants begins October 1, 1989; open until filled. Send vita to: Dr. Keith A. Russell, Chairperson, Department of Accounting & Finance, Southeast Missouri State University, Cape Girardeau, MO 63701. The University is an equal opportunity/affirmative action employer.

#468 Ph.D., CPA with MS in Computer Science seeks faculty position. Experience teaching undergraduate/graduate courses in financial and managerial accounting. Desire to integrate computer background into accounting curriculum.

#469 STANFORD UNIVERSITY Graduate School of Business invites applications for a possible nontenured faculty position in Accounting, effective September 1990. Candidates must have a Ph.D. or a dissertation in process, and a high level of accomplishment or promise in both scholarly research and graduate-level (M.B.A. and Ph.D) teaching. Stanford University is an Equal Opportunity Employer and welcomes applications from minorities and women. Applications should be received by February 26, 1990 and should include resumé and names and addresses of references. Applicants at the Assistant Professor level should also include transcripts from colleges and universities attended. Applications must be forwarded in entirety to the Associate Dean for Academic Affairs, Graduate School of Business, Stanford University, Stanford, California 94305-5015.

#470 GONZAGA UNIVERSITY is seeking applications for a tenure-track position in TAX ACCOUNTING beginning Fall 1990. An appropriate doctorate is required (ABD considered). Evidence of effective teaching with a commitment to scholarship sought. Primary teaching includes undergraduate and graduate courses. Gonzaga is in Spokane, Washington, a city of 350,000 with excellent cultural facilities. Send applications and references to: Dr. Lawrence D. Lewis, Chairman, School of Business, Gonzaga University, Spokane, WA 99258. Gonzaga is an EEO Employer.

#471 UNIVERSITY OF WISCONSIN-GREEN BAY. Tenure-track position as Assistant Professor of Accounting for Fall 1990. A teaching load of 21 credit hours per year, primarily at the undergraduate level, is normal. Research reassignments are available. Opportunity to teach in a cooperative AACSB-accredited MBA program. Summer teaching generally available. Ph.D. or DBA in Accounting is required for appointment to rank of Assistant Professor. ABDs nearing completion may apply for appointment at the rank of Instructor. A competitive salary/benefits package will be offered. Apply to: Dr. Karl M. Zehms, Chairman, Managerial Accounting Program, Suite 710, Library Learning Center, University of Wisconsin-Green Bay, 2420 Nicolet Road, Green Bay, WI 54311-7001. For further information, call 414-465-2495. UWGB is an equal opportunity, affirmative action employer. Racial or ethnic minorities, women, and disabled persons are encouraged to apply and may identify themselves as such if they wish.

#472 Ph.D., CPA, experiences in government service, public accounting, and university teaching (12 years at the full-professorship level), seeks to return to the academia by September 1990, either tenure-track or visiting. Teaching interests (each supported by research, publications, and international involvement): cost/management accounting, information systems, auditing, and international accounting and reporting.

#473 THE UNIVERSITY OF AKRON is seeking several applicants for tenure-track faculty positions. The School of Accountancy offers its 800 majors a bachelor's degree, a Master of Taxation, a joint Master of Tax/JD, and an accounting concentration in the MBA program. The Accounting program is AACSB-accredited as is the College of Business at both the graduate and undergraduate levels. Applicants should possess an earned doctorate (PhD or DBA; ABDs considered); certification is desirable. Candidates should be committed to a balance of teaching excellence, research and publication, and service. Persons with specialty areas in information systems and/or auditing are particularly encouraged to apply. Salary is competitive. Contact the Chair of the Search Committee: Dr. Penny Marquette, School of Accountancy, The University of Akron, Akron, Ohio 44325. The University of Akron is an equal opportunity employer; women and minorities are encouraged to apply.

#474 UNIVERSITY OF MINNESOTA'S ACCOUNTING DEPARTMENT invites applications for Assistant Professor of Accounting. Other ranks considered subject to applicant's qualifications and department needs. Visiting position will be considered. Applicants should possess a Ph.D. or expect soon, else instructor rank will be assigned until Ph.D. is completed. Responsibilities include conducting research, service and teaching. Two application pools will be formed. Applications must be received prior to November 1, 1989 for permanent and visiting positions. University of Minnesota is an equal opportunity educator and employer and specifically invites and encourages applications from women and minorities. Please send application and vita to: David Dittman, Accounting, Carlson School of Management, University of Minnesota, 271-19th Avenue South, Minneapolis, MN 55455-0413. Phone (612) 624-6506.

#475 UNIVERSITY OF MINNESOTA'S ACCOUNTING DEPARTMENT invites applications for Assistant Professor of Accounting. Other ranks considered subject to applicant's qualifications and department needs. Visiting position will be considered. Applicants should possess a Ph.D. or expect soon, else instructor rank will be assigned until Ph.D. is completed. Responsibilities include conducting research, service, and teaching. Two application pools will be formed. Applications must be received prior to March 1, 1990 for permanent positions and prior to May 1, 1990 for visiting positions. The University of Minnesota is an equal opportunity educator and employer and specifically invites and encourages applications from women and minorities. Please send application and vita to: David Dittman, Accounting, Carlson School of Management, University of Minnesota, 271-19th Avenue South, Minneapolis, MN 55455-0413. Phone (612) 624-6506.

#476 AUBURN UNIVERSITY invites applications and nominations for the Charles McKenzie Taylor, Jr. Professorship in Accounting. The Taylor Professor should be interested in assisting with the development of professional accounting education and in providing effective leadership in the School's research efforts. The Taylor Professor will receive a competitive compensation, and other support services, graduate student assistance, and a reduced teaching load. Position open until filled. Auburn University is Alabama's land-grant university and largest publicly supported institution of higher education. Nominations and applications should be sent to: Dr. Robert W. Rouse, Chairman, Taylor Professorship Search Committee, School of Accountancy, Auburn University, AL 36849-5247. (205) 826-5340. An Equal Opportunity, Affirmative Action Employer. Minorities and women are encouraged to apply.

#477 SCHOOL OF URBAN AND PUBLIC AFFAIRS, CARNEGIE MELLON UNIVERSITY, JUNIOR, TENURE-TRACK. One or more accounting individuals with accompanying expertise in management information systems, public-sector accounting, public finance, information economics, financial economics, or other areas of interest to a management school emphasizing the public sector and public policy. Work with a multi-disciplinary faculty (with particularly close connections to the business school, GSIA) within an interdisciplinary University environment. Applicants should have a clear commitment to research, should be seeking rich problem-opening opportunities, and should be interested in research involving the application of accounting theory and methods to a wide variety of managerial, societal, and public policy problems on which accounting issues have a strong impact. For consideration, send a detailed resumé and some recent research work to: Alfred Blumstein, Dean, School of Urban and Public Affairs, Carnegie Mellon University, Pittsburgh, Pennsylvania 15213. Carnegie Mellon University is an Affirmative Action, Equal Employment Opportunity Employer.

#478 UNIVERSITY OF ALASKA ANCHORAGE is seeking applicants for a tenure-track position beginning Fall 1990. Applications will also be accepted for a visiting appointment. While all areas will be considered, the primary needs are financial accounting, auditing, and accounting systems. Ph.D. or DBA (accounting emphasis) or a doctoral candidate in the dissertation stage is required. Applicants should be able to demonstrate teaching effectiveness and scholarly research capabilities. Rank and salary will be commensurate with academic preparation and experience. Anchorage is the financial center of Alaska and offers unlimited recreational opportunities throughout the year. Closing date: review of applications will begin December 1, 1989 and continue until filled. Send letter of application and resumé to: Personnel Services Office, University of Alaska Anchorage (UAA), 3890 University Lake Drive, Anchorage, Alaska 99508. UAA is an Equal Opportunity/Affirmative Action Employer. Must be eligible for employment under the Immigration Reform and Control Act of 1986.

#479 NORTHERN ILLINOIS UNIVERSITY anticipates tenure-track openings for accounting faculty starting August 1990. All ranks and fields will be considered but likely openings will be in systems and taxation. Terminal degree required, but ABDs will be considered at the assistant level. CPA or other certification desirable. Systems and taxation positions require specific course work and/or dissertation in specialty. Northern Illinois University faculty are committed to excellent teaching, professional involvement, and professional research. Interested applicants should send resumé by December 1, 1989 to John Smith, Chair, Department of Accountancy, Northern Illinois University, DeKalb, IL 60115. Northern Illinois University is an Equal Opportunity, Affirmative Action Employer.